CONTRIBUTIONS TO THE HISTORY OF AUSTRALASIAN ORNITHOLOGY

Edited by
WILLIAM E. DAVIS, JR.
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and
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CONTRIBUTIONS TO THE HISTORY OF AUSTRALASIAN ORNITHOLOGY

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MEMOIRS OF THE NUTTALL ORNITHOLOGICAL CLUB, NO. 14

William E. Davis, Jr. and Jerome A. Jackson, Memoir Series Editors

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Nuttall Ornithological Club
Cambridge, Massachusetts
© 2008 by Nuttall Ornithological Club
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Printed in the United States of America
ISBN 1-877973-43-2

Publications of the Nuttall Ornithological Club may be obtained from the Nuttall Ornithological Club, c/o Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts 02138.

Preface

This book has its genesis in a symposium in 1991 at the annual meeting of the Association of Field Ornithologists, at Ohio Wesleyan University, in the USA. The topic was the history of North American ornithology. The symposium was co-chaired by Jerome A. Jackson and William E. Davis, Jr. Because of the positive response to the symposium, Davis and Jackson decided that it was desirable to provide an outlet for the publication of the papers presented at the meeting and recruited additional papers that together were published in 1995 as *Contributions to the History of North American Ornithology*. The volume was well received and Davis and Jackson subsequently recruited more historically oriented papers and in 2000 published *Contributions to the History of North American Ornithology, Volume II.* Volume III is currently in press and volume IV is in preparation.

Walter Boles of the Australian Museum in Sydney, wrote a review of volumes I and II for *Emu* (2002, 102:387) and concluded his review with the statement: ". . . a similar volume of this type could be usefully compiled for Australasia. It would fit nicely on the shelf next to *The Flight of the Emu.*" William E. Davis, Jr. has collaborated with Harry F. Recher in a series on projects on Australian birds beginning in 1982 when Davis was on sabbatical leave from Boston University, and Recher was head of Vertebrate Ecology at the Australian Museum. We took Walter Boles' comments to heart, and together with Walter recruited papers dealing with the history of Australasian ornithology for this volume, hopefully the first of several volumes.

We have ordered the chapters roughly chronologically, with historically earliest subjects first, and within time periods by closeness of subject matter, for example, the two museum chapters are grouped together, as are the chapters on systematics and the National Collections. The chapter on threatened species is the culminating chapter, because, although threats to species are long-standing, the focus of interest on threatened species is relatively recent.

Many of the chapters in this book are "court histories," written by people who participated in making the history they write about. Despite the obvious potential for bias, we think that histories written by "insiders" have some advantage over those prepared by "disinterested" historians. Insiders have the advantage of personal experience, an intimate knowledge of their subject matter, and access to rich anecdotal material that adds a distinctive character to descriptive or interpretive history.

Many of the histories presented here are largely descriptive rather than interpretive, but as such, are a useful first step in laying the groundwork for future analysis. We hope that the essays in this volume will provide stimulus and interest, as well as a source of reference, to future students of ornithological history.

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A Man of Great Zeal and Assiduity[1] : The Pioneering Naturalist John Gilbert in Australia, 1838-1845

*Clemency Fisher**

ABSTRACT.—The English naturalist John Gilbert (1812-1845) is credited with collecting the "type" specimens of at least 8% of all forms of recent Australian birds and mammals. He also collected the first specimens of many species of Australian reptiles, amphibians, fish, molluscs, insects, and plants. His employer, John Gould (who is often called the father of Australian ornithology, and for whom the Gould League is named), scientifically described over 300 Australian birds and about 50 mammals, most of which are still valid taxa, and many of which he based on Gilbert's specimens.

Gould and Gilbert explored Australia between 1838 and 1845 to gather material for Gould's subsequent multi-volume publications *The Birds of Australia* (1840-1848) and *The Mammals of Australia* (1845-1863). Gould himself only stayed in Australia between September 1838 and April 1840, and concentrated on the fairly well established British settlements in Tasmania and south-eastern Australia. Gilbert, however, explored the younger colonies of Swan River and King George's Sound in Western Australia and also visited Port Essington, a remote British naval outpost on the north coast, between July 1840 and March 1841, after which he returned to England. Gould sent Gilbert back to Australia on his own in 1842.

After about 18 more months exploring Western Australia, Gilbert took ship for Sydney and then in 1844 worked his way up to the Darling Downs area of what is now southern Queensland. The Darling Downs proved to be an important area, as it was here that Gilbert collected many new mammals, as well as about seven specimens of a beautiful new parrot—the now extinct Paradise Parrot (*Psephotus pulcherrimus*). It was also on the Downs that Gilbert met the German explorer Ludwig Leichhardt and joined his expedition, the primary purpose of which was to become the first party of Europeans to cross Australia from east to north coasts. Gilbert collected several new birds during the travels of the Leichhardt Expedition northwards along the watercourses of eastern Queensland, but unfortunately was killed during an Aboriginal attack in Cape York Peninsula on 28 June 1845.

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Gilbert and Gould's Australian specimens are now scattered in museums throughout the world. There are particularly significant collections at the Natural History Museum, London and Tring, at the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, at *Naturalis,* Leiden (Netherlands), and at the Muséum national d'Histoire naturelle in Paris, but perhaps the best preserved (most of which still bear their original field collection labels) are now in National Museums Liverpool, United Kingdom. This material was in a private museum at Knowsley Hall in Lancashire, which was bequeathed to the people of Liverpool in 1851 by the natural historian and zoo-keeper Edward Stanley, 13th Earl of Derby, to whom John Gould sold numerous specimens. The earl's collections founded the Liverpool Museum. (Figures 1, 2).

However, Gould's primary collection of Australian birds, which he asserted consisted of those birds used as models for the hand-coloured plates in his huge books on the Australian fauna, is now in the Academy of Natural Sciences, Philadelphia. The approximately 2000 birds in this collection have since had their labels removed, and the difficulty of deciding exactly which are types, and which are not, has been compounded by two badly-advised papers by past Academy curators (Stone 1913, Meyer de Schauensee 1957). Many of the Gould Collection birds at the Academy have thus become associated with the wrong locality, or allotted incorrect type status.

Until recently, few of the many Gould specimens elsewhere in the museums of the world had been checked for type status. For the last 25 years, research has been undertaken as part of a long-term project to re-assess all Gould and Gilbert's Australian specimens, which—as well as assessing any with possible type status—includes a reappraisal of details such as their age and sex, exact collecting locality, and date. This task has involved searching the collections of nearly a hundred museums, and checking the resulting finds against Gilbert's field notes and letters, his diary from the Leichhardt Expedition, and against Gould's original type descriptions. As a result, much material in museums other than the Academy of Natural Sciences in Philadelphia has been identified as having type status, and in many cases these specimens are better qualified as potential Gouldian types than those at the Academy. Gould's business acumen may have clouded his ability to come clean (or perhaps even care) about exactly which specimens were his types, as he had already sold many of these to other institutions years before he offered the collection of birds "being the originals of my work" to Edward Wilson.[2]

This careful, much overdue documentation of Gilbert and Gould's collections is an increasingly useful and well-used resource for Australian zoologists. As DNA studies make increasing use of museum specimens, and give us greater knowledge of the relationships among species, so the details of their type status and exact collecting dates and localities increase in value.

Much of the information in this chapter is based on Fisher (1992), unless referenced otherwise.

John Gilbert, who was to become one of the most important figures in the discovery and description of Australia's bird and mammal faunas, came from humble origins and his early life is still only sketchily known. Gilbert was born in Newington Butts, south London, on 14

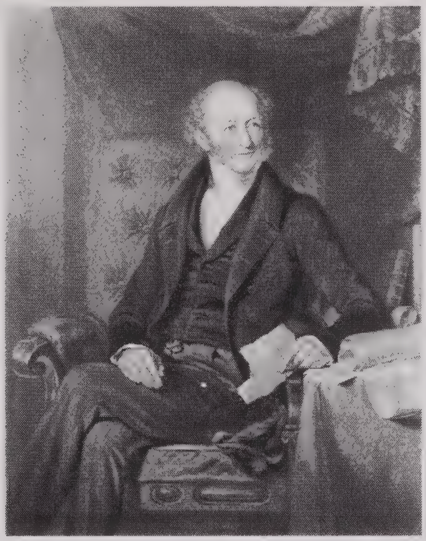

Figure 1. The great aristocratic naturalist Edward Stanley, 13th Earl of Derby. He obtained many of John Gilbert's Australian specimens from John Gould. Lord Derby's collections founded the Liverpool Museum in 1851.

March 1812 and was christened at the non-conformist chapel of Lady Huntingdon in Clerkenwell, central London on 25 October of that year. He was the son of William (a carpenter) and Ann Gilbert, natives of Kent in south-eastern England, and from villages just three miles (4.8 km) apart. The register for Lady Huntingdon's Chapel (L.H.C.) has also provided the dates of birth of Gilbert's two brothers, William in 1813 and Thomas in 1818. John Gilbert also had a sister, from whom his only presently traceable living relatives are descended, although she is not in the L.H.C. register and we do not know her name.

Gilbert joined the Zoological Society of London as a taxidermist in 1828, at the age of 16. At the zoo, Gilbert worked with (and was trained by) John Gould, the ornithologist and entrepreneur, later famed as a bird artist and a publisher of fine folio works on birds and mammals, such as his monumental works *The Birds of Australia* (1840-1848) and *The Mammals of Australia* (1845-1863). The Society's Museum, where Gilbert and Gould worked, was at 33 Bruton Street until 1836, when it

Figure 2. World Museum Liverpool, formerly the Liverpool Museum and now part of National Museums Liverpool. The museum holds one of the most important collections of Australian birds and mammals in the world.

moved to 28 Leicester Square. Gilbert and Gould also practised the art of taxidermy as a private side line to their employment at the zoo; they are both entered as "Naturalists" in the London Directory of businesses for 1835. Gilbert's address was given as 130 High Holborn. He shared a house with a baker and a "coach liner." He is also listed in the Directory under "Animal Preservers."

John Gilbert was probably married twice, his second wife, Esther Sadler, being the inadvertent reason for his dismissal from the Shropshire and North Wales Natural History Society. The Trustees of this society formed a new museum in Shrewsbury (the childhood home of Charles Darwin) in 1836 to care for their specimens, appointing Gilbert as its first Curator. His contract was for one year, at a salary of £80 per annum plus his apartments and coal. The salary was to be supplemented by £10 per annum from Thomas Eyton, a Shropshire landowner who was a keen naturalist (and incidentally an expert on the duck family and on bird bones), for Gilbert to curate his private muse-

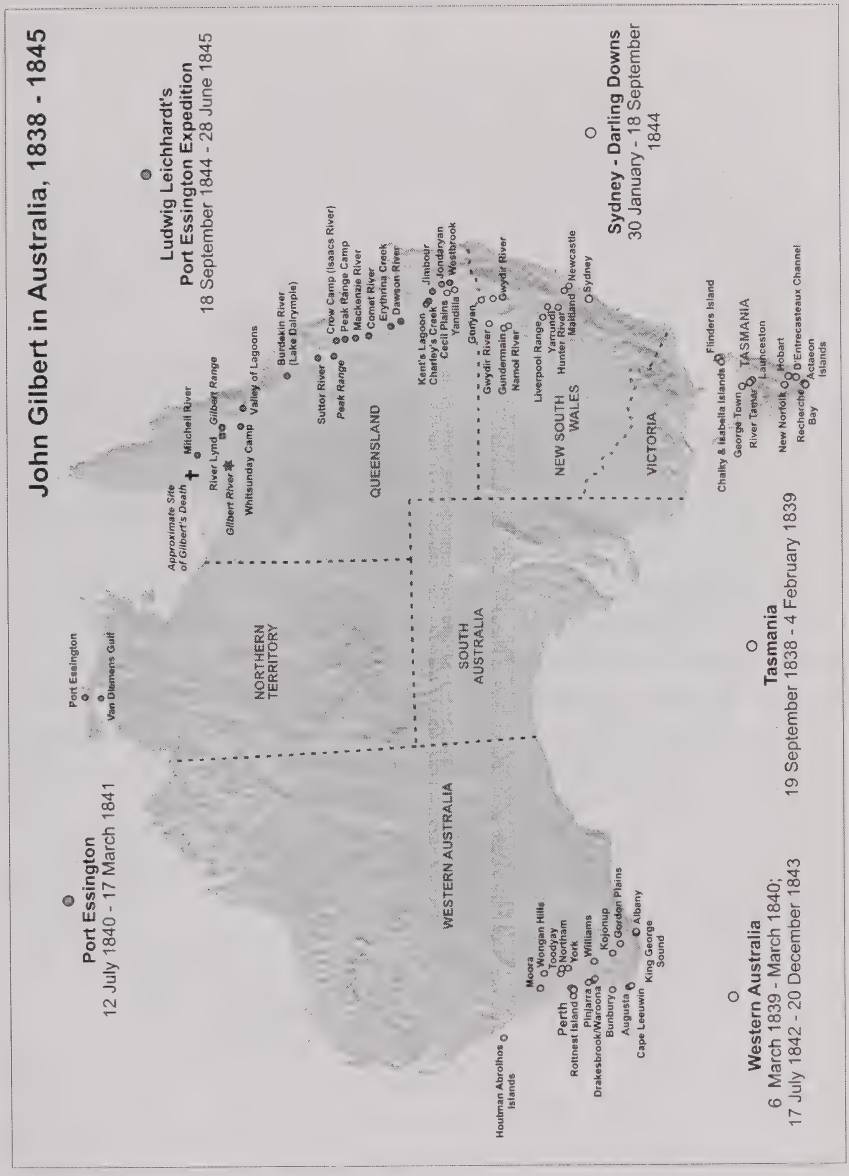

Figure 3. John Gilbert's main collecting localities in Australia, 1838-1841 and 1842-1845. © Tom Wilke/Leo Joseph

um. On 1 June 1836 John Gilbert started work for the Society in a building in Dogpole Street, in the centre of Shrewsbury. During his curatorship Gilbert made donations of his own material to the Society's museum (shells and small mammals) and it is recorded that the Society also purchased Gilbert's own collection of birds for £12 (Torrens 1987).

Gilbert went about his task of building up the museum's collections and arranging their storage. In July he was sent by the Society to Welshpool to investigate the remains of the "Shropshire Mammoth," a find which is still of considerable fame. In November 1836, the Report of the Society's Council at the Annual General Meeting noted his good progress in arranging and cataloguing the collections.

However, things were about to become less smooth. In November 1836, John Gilbert apparently re-married. The marriage certificate described Gilbert as a widower, Esther Sadler as a spinster. The Trustees became unhappy with the awful possibility of their dedicated assistant having company in his rooms at the museum. On 7 March 1837 Gilbert wrote to the Council of the Society offering to resign:

> ". . . a dissatisfaction having arisen among the Members of the Council respecting my bringing my wife here . . . another objection is made that my wife engages my room, now this has never been the case, on the contrary my room is, and has been at all times, not only disengaged, but always ready either for the Council or the Secretaries to transact their business" (SPL—for such references, see "Acronyms used" after "Conclusions")

Gilbert indeed complained that, instead of the apartments he had been led to expect, he had been left by the Trustees with just a bedroom—which was next to his malodorous work room.

On 9 March 1837 the Trustees accepted Gilbert's resignation, but immediately offered him instead a part-time job for less money—financial problems probably being the real reason behind their original complaint. This compromise Gilbert refused, and in April 1837 his contract was terminated and he was paid the last instalment of his salary, a total of £67. He must have then returned to London, and presumably to employment as a private taxidermist. There is no record of what happened to the wife who had been the excuse for his dismissal—although the later comments of a Mrs. Brockman, an acquaintance of Gilbert's in Western Australia, hint that Gilbert might have been widowed twice and that he had been left with a young daughter. There has never been any subsequent trace of the latter.

In March 1838, Gilbert wrote to Thomas Eyton, from John Gould's address in Golden Square, London (SPL), offering Eyton the chance to buy Gilbert's own collection (which by then included many skeletons and over 80 bird skins). Gilbert's reason for disposing of his collection was that he had been invited to go to Australia as John Gould's field assistant, a position that he must have jumped at. Indeed, it is quite possible that John Gould would never have attempted his great Australian expedition but for the chance of being able to take John Gilbert with him.

In 1837-1838, John Gould had produced a work (*Synopsis of the Birds of Australia and the Adjacent Islands*) that included details and portraits of many Australian birds. At much the same time Gould had also begun a folio work, *The Birds of Australia and the Adjacent Islands*. Gould based these portraits on his own material, specimens in other private collections such as that of the Linnean Society, and those in public museums such as the British Museum. During his work on these books, it had become increasingly obvious to Gould that many Australian bird species remained undiscovered and undescribed, and that details of the natural history of the known species was for the most part unknown. Gould realised that only by visiting the continent of Australia, and investigating the fauna for himself, would he be able to fulfil his ambition of publishing large folio, well-illustrated books that would include descriptions and paintings of the majority of the forms that existed there. Thus John Gilbert, then aged 26, joined John Gould, Gould's wife Elizabeth (a talented bird artist whose brothers, Charles and Stephen Coxen, were early squatters in eastern Australia), the Gould's eldest son, a nephew, and their two servants, on the barque *Parsee,* which sailed from London on 16 May 1838.

They travelled into the interior of Tenerife for two days on a stopover, and Gould and Gilbert collected a few sea birds en route. Eventually, on 19 September, the party arrived at Hobart, Tasmania, living first on Davey Street, but later moving into Government House with the Governor, Sir John Franklin (later of Arctic fame), and his wife. The party soon began to collect zoological specimens in earnest, assisted by Sir John's Private Secretary, Ronald C. Gunn, who already had a significant collection of bird specimens (and indeed was a great expert on the Tasmanian bird fauna).

Gould and Gilbert's arrival in Australia coincided with a global turning point in the way natural history collections were assembled. From being a sideline performed (usually rather badly) by army officers on military expeditions, natural history collecting was becoming a professional and full-time activity, undertaken mainly by men of more humble backgrounds. This new breed of naturalists had the immediate advantage of being able to stay in one place for as long as they wished, enabling that area to be searched for new forms. This proved much more rewarding as far as the smaller, more retiring and obscure species were concerned. John Gilbert's Australian collections are particularly rich in such forms, many obtained from favourite collecting sites that he visited again and again. He collected many new honeyeaters and other small birds such as grass finches, but was also in one place long enough to set traps for small mammals. This accounts for the large numbers of new species and subspecies of dasyurids (carnivorous marsupials, many of which are small, < 30 g) and rodents which Gilbert is credited with discovering.

Gould's decision to visit Australia therefore came at an extremely propitious moment for his ambitions—one might say, the timing of a genius, not to mention financial sharpshooter. John Gilbert, who almost unquestioningly followed the sometimes lightning decisions of his employer, was destined to flesh out Gould's visions of grandeur.

TASMANIA

Many of the collecting localities the two naturalists visited while in Tasmania can be identified from the labels on the specimens they collected. In September 1838, they were collecting in the vicinity of Mount Wellington, in October at Mount Dromedary, Brown's River, "Sassefurs Valley," and Kangaroo Point. The earliest of their specimens that has been located is a Strong-billed Honeyeater (*Melithreptus validirostris*),[3] which Gilbert collected at Brown's River on 6 October 1838.

They did not collect only small birds: on 2 November Gilbert prepared a Chestnut Teal (*Anas castanea*) he had shot on the River Derwent above Hobart Town and on 4 December, at Bushy Park, near New Norfolk, they obtained a Wedge-tailed Eagle (*Aquila audax*).[4]

Later in December, John Gould and Lady Franklin arranged a sailing excursion on the Government Schooner down to the south of the island, where they visited Recherche Bay and the Green and Actaeon Islands in D'Entrecasteaux's Channel. They collected an Orange-bellied Parrot (*Neophema chrysogaster*) on Actaeon Island on 12 December[5] and another Chestnut Teal on 21 December from D'Entrecasteaux's River.[6] Gilbert was obviously on the expedition to the south (his writing is on the field labels), although there is not a single mention of him in Lady Franklin's diary of the trip. Perhaps to her he was just Gould's servant.

In January 1839, both Gould and Gilbert set off across Tasmania to the north coast and the town of Launceston. Here the pair discovered a new bat, which the British Museum curator John Gray later named *Scotophilus gouldii* (Gould's Wattled Bat *Chalinolobus gouldii*) after John Gould.[7] Their ultimate destination was the Bass Straits Islands between Tasmania and the Australian mainland, which are noted for their bird life. The pair of naturalists first visited Chalky Island, with an aim to then visit Isabella, Flinders, and King islands.[8] They got to Isabella and Flinders, but an untoward accident to one of the other crewmembers—who was killed when his gun went off accidentally—upset Gould so much they returned to the Tasmanian mainland earlier than they had planned.[9]

It was at this time that Gould made the decision to send his assistant to another part of Australia. He must have become increasingly aware of the vastness of the Australian continent, of which Tasmania was only a small part, and that for the main part the species they had collected there were not new to science.[10] If Gould was to cover the birds and mammals of Australia adequately in his proposed publications, he needed Gilbert to start collecting in another area. Gould must have discovered the imminent departure of the ship *Comet* for the Swan River Colony of Western Australia, and then decided, on the spot, to send Gilbert there—without giving his long-suffering assistant the chance to return to Hobart for his possessions.

On 21 January 1839, Gould wrote a letter to Kerr Alexander and Co. of Launceston, requesting credit of £65: "As I have resolved to send my Man Mr John Gilbert on to Swan River in prosecution of the objects of my visit to the Colony" (MLS). Gould returned to join his wife in Hobart; on the 29th he sat down and wrote out a detailed set of instructions for Gilbert:

> ". . . your attention will be principally directed to ornithology, you will form as complete a collection of birds as you can during

> your short stay and those in their various stages of plumage together with their nests and eggs, and skeletons of each form . . . secondly your attention will be next directed to Mamalia [sic], one or two of every species of which, even the most common (particularly the Kangaroos) will be desirable. Insects crustacea and shells although very desirable, will only occupy so much of your time and attention as will not materially interfere with the main object of your visit . . . ." (Gould Collection, General Library, NHM).

WESTERN AUSTRALIA

On 4 February 1839, Gilbert left Launceston on the *Comet* bound for the Swan River Colony. The ship arrived on 6 March after a fine passage, although during the voyage he had been "most scurvily treated by the Captain & his principle [sic] Officer in every department, his wife."[11] Gilbert settled down to collect in the neighbourhood of Perth (at that time not much more than a village), and was kindly received by Governor John Hutt, with whom he breakfasted, but was somewhat disconcerted to find the cost of living in the colony extremely high, and that he was experiencing great difficulty in obtaining specimens or information from the settlers:

> "The assistance I expected from the Gentry, was only visionary, for none of them seem at all disposed to keep their promises in exerting themselves in the least . . . ."[12]

The problem was also to some extent caused by the German collector Johann Preiss, who had already virtually cornered the market for specimens—in many cases, he was able to pay much higher prices for material than Gilbert was. Preiss's arrival in Western Australia had predated Gilbert's by a year, and in many ways it seems Preiss stole his thunder.

Despite these problems, along with suffering eye irritation due to the intense glare and being thoroughly bitten by mosquitoes, Gilbert considered that:

> "I could not have located myself in a better situation for collecting, than here at Perth, I have not to walk more than half a mile, when I am fairly in the Bush, or among the numerous Lakes,

> which surround the North side of Perth, while the River Swan, is close on the other side of the Town, as well as the River Canning."[13]

As a result, by the end of May 1839 Gilbert had prepared 330 specimens of birds and 50 skeletons, all collected within ten miles (16 km) of Perth. He had already collected several birds that were later the basis for Gould's descriptions of new species, such as a thornbill of which Gilbert collected several specimens, the earliest of which still bears his field label with a collecting date of 11 March 1939. This was a Western Thornbill, named *Acanthiza inornata* by Gould in 1841.[14]

Two days later Gilbert collected a specimen[15] of another new species, a honeyeater, which Gould named *Melithreptus chloropsis* in 1848 (this is now classified as the south-western form of the White-naped Honeyeater, *Melithreptus lunatus chloropsis*). According to Gould in his type description in *The Birds of Australia* (1840-1848, vol. 4, text to plate 73) the White-naped Honeyeaters which Gilbert saw were almost always in the upper branches of *Eucalyptus* trees, feeding on plant nectar and insects. Gilbert found a nest of this species in the month of October, formed of sheep's wool and small twigs and containing three eggs.

Another new species was discovered in March. In April 1839 Gilbert mentioned in a letter to Gould that "Amongst the most prominent of my birds . . . [is] a brown creeper with very strong legs and feet."[16] This probably referred to a bird Gould later named *Climacteris rufa*, the Rufous Treecreeper; Gilbert collected one of the type specimens on 30 March 1839.[17]

Gould also based his 1841 name *Meliphaga mystacalis* on some of Gilbert's early Western Australian specimens, later quoting Gilbert's field notes in *The Birds of Australia*. Gilbert had recorded that these birds (now considered as belonging to the western form of the White-cheeked Honeyeater, *Phylidonyris nigra gouldii*), were common near Perth and Fremantle, but sparingly dispersed over the other districts on the Swan River.[18] Another new bird for Gilbert was the western form of the Silvereye (*Zosterops lateralis*), which Gould named *Zosterops chloronotus* from specimens collected by Gilbert in the Perth area.[19]

Perhaps the most spectacular of Gilbert's new species was the Freckled Duck, later named *Stictonetta naevosa* by John Gould, which Gilbert was told was such a great rarity it had no Aboriginal name (indeed, it is one of the rarest ducks in the world). Gilbert seems to have only collected one specimen himself at this time, although he also saw a female in another collection (perhaps that of Johann Preiss).[20]

However, some of the new mammals Gilbert discovered in the first few months of his stay in Western Australia were even more important than the birds, as they were species which are now extinct or greatly endangered. *Onychogalea lunata*, the Crescent Nailtail Wallaby, has not been seen since the middle of the last century. Gilbert noted that the "Waurong" was:

> "found in the Gum forests of the interior [of Western Australia], where there are patches of thick scrub, and dense thickets, . . . at the slightest approach [it] immediately takes to the thick scrub . . . ."[21]

On 11 April 1839 Gilbert had written[22] to his employer, who was still collecting on the east coast of Australia, that he thought it worth staying longer in the Swan River Colony than he had originally intended because, as the spring season came round at the end of August, he could then collect birds in breeding plumage and their nests and eggs. Gilbert also said that he was planning a trip into the interior, towards the small settlement of York, "about 70 miles in the interior . . . east." However, he does not appear to have set off until the month of June, as the earliest specimen found from this inland expedition is a Common Brushtail Possum (*Trichosurus vulpecula*) which Gilbert collected at Northam, then a little village on the Avon River, north-west of York, on 9 June.[23] On the next day he collected a Black-tailed Native-hen (*Gallinula ventralis*) near York[24] and he appears to have stayed in the York area for about 10 days.[25]

A new species that Gilbert found in the York area of the Swan River Colony was the Black-footed Rock-wallaby (*Petrogale lateralis*), which no longer occurs in this area and indeed is now rare in Western Australia. Gilbert recorded that these wallabies bounded along with their tail curved upwards like a greyhound, and that he had shot a "fine series of this beautiful species," by sneaking up on the caverns where they sheltered, with his shoes off. He also noted that, even then, they had a very limited range, being "tolerably numerous about the York district" but not occurring north of the Toodyay River, or south of the head of the Dale River.[26]

In the interior Gilbert also collected specimens of another new kangaroo, which was called the "Boor-dee" by the Aborigines of these "mountain districts." These little kangaroos lived in extended family burrows, with multiple entrances and dug with enormous engineering skill. They dumped the earth they excavated in large mounds near the entrances. They were destructive in the vegetable gardens of the settlers, with a particular penchant for peas and beans. Gilbert noticed that many of them had a lot of fur missing, and wondered whether they had some sort of mange, like dogs do. Perhaps a combination of being unpopular garden visitors, easily killed (as their burrows were given away by the mounds of earth nearby, and they could be easily shot as they emerged at dusk), and suffering from some disease brought in by the settlers contributed to their downfall. These were of the south-western form of the Burrowing Bettong (*Bettongia lesueur graii*), described by Gould from Gilbert's specimens,[27] a subspecies that is now extinct. Indeed, only a small population of the nominate subspecies, *B. l. lesueur*, still exists, confined to Bernier, Barrow, Boodie, and Dorre islands off the coast of Western Australia.

Gilbert also collected the type specimens of the Grey-fronted Honeyeater (*Lichenostomus plumulus*) in the York district. Interestingly, from this locality, these specimens were collected far to the south-west of the present range of this bird, which has retracted because of vegetation clearance. Gilbert was most impressed by the song of this honeyeater, which had a voice of great variety: "most general is a remarkably clear loud and shrill shake resembling the Sportsman's Pea Whistle, which is continued without interval, a great length of time." He said he had only come across it in the York district[28] (Figure 4).

Gilbert returned to the coast after the end of June. He was collecting at Fremantle at the end of July and on 10 August was hunting Tammar Wallabies (*Macropus eugenii*) on Garden Island, in the mouth of the Swan River.[29] By this time, he had made a most important acquaintance—the botanist James Drummond. Gilbert, Drummond, Johann Preiss, and a Dr. Walker were together on this excursion, which also included a visit to Rottnest Island.[30]

The significance of James Drummond, both as a naturalist and as a colleague to John Gilbert, is worth emphasising. The Drummonds were well-established Swan River Colony settlers by the time Gilbert made his first trip to Western Australia; the family obviously took him under their wing. James Drummond had come to Western Australia in 1829 as

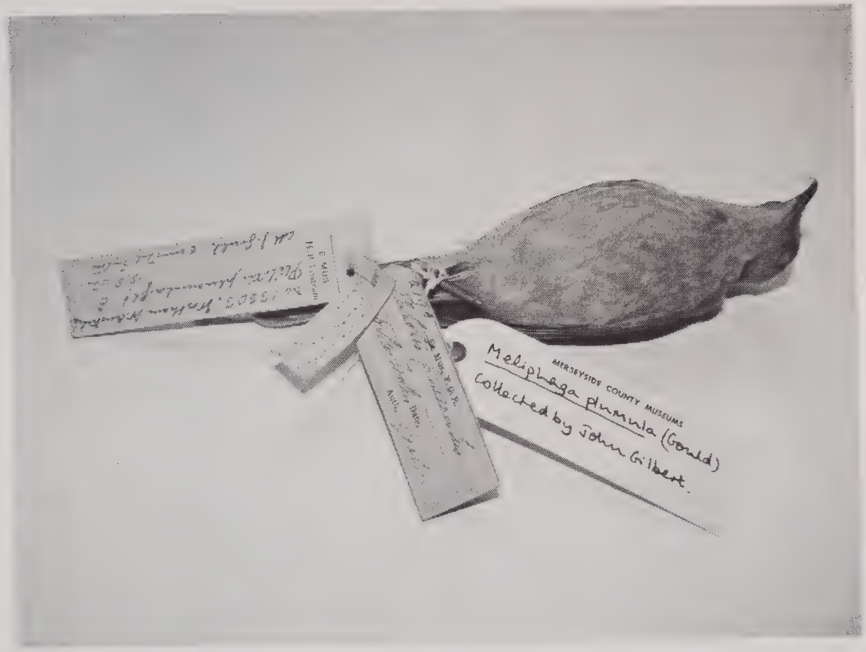
MERSEYSIDE COUNTY MUSEUMS
Meliphaga plumula (Gould)
Collected by John Gilbert.

Figure 4. Gilbert collected the type specimens of the Grey-fronted Honeyeater (*Lichenostomus plumulus*) in the York district of Western Australia. His specimens were collected far to the south-west of the present range of this bird, which has retracted because of vegetation clearance. On Gilbert's second visit to Western Australia, he collected a Grey-fronted Honeyeater even further west, at "Wortham" [= Northam], on 18 August 1842. This bird (LIVM T.13303) is now in Liverpool, obtained from the collection of Canon H. B. Tristram, but formerly in the museum of the Shropshire landowner Thomas Eyton.

an "agriculturalist" and later became Western Australia's first Government Botanist. He settled at "Hawthornden," near Toodyay on the Avon River; this became the base for many of Gilbert's collecting excursions. Johnston Drummond, James's son, was also to become a close friend of Gilbert's. Johnston was included in several of the trips his father made with John Gilbert, such as their exploration of the King George's Sound area in 1843.

In September 1839 Gilbert again wrote to Gould.[31] He had tried to get a passage on the *Elizabeth* so that he could join Gould in Sydney, but her captain would not take passengers. However, the good news was that he had not been idle—Gilbert had increased his collection to 530 bird specimens from 150 forms; he also had 13 forms of mammals, 70 skeletons, 7 bottles of reptiles, a few fish, 500 insects, 400 shells, a few crustacea, three to four hundred plants, and many nests and eggs. In this letter Gilbert also referred to the fact that he had finally managed to obtain one skin of the "Native Pheasant,"[32] but he had not seen the living bird. He had been told by the settlers about the huge mounds of sand and earth these birds built, in which they laid their eggs and then left them to incubate on their own, and was determined to see these for himself.

Gilbert also reported that he had been:

> "in the Interior as far as any Europeans have yet settled, but unfortunately at the time I was there, the Natives committed several frightful murders on the white people . . . and it was considered very dangerous to move far away from the settler's houses . . . ."

However, he returned to the interior at the end of September 1839—where he travelled 30 miles (48 km) further into the bush than before—and again in November. Almost the only evidence that Gilbert went into the interior for at least a week in the latter month comes from dates on Gilbert's field labels, although Gould also mentioned in his *Handbook* (1865, vol. 1:52) that on 10 November 1839, Gilbert had found a nest of the Square-tailed Kite (*Lophoictinia isura*) about four miles (6.4 km) east of the River Avon.

Three of these field labels are attached to specimens now in National Museums Liverpool—a Pacific Golden-Plover (*Pluvialis fulva*) collected near York on 3 November 1839, a Square-tailed Kite collected at "Gwambyggyne" (Gwambygine, a few miles south of York, on the Avon River) on 7 November, and a Black Honeyeater (*Certhionyx niger*), again from "Gwambyggyne," obtained on 10 November. Another original Gilbert label from this period belongs to a White-fronted Honeyeater (*Phylidonyris albifrons*) collected at "Gwambygyne" on 9 November 1839; this is now in the Museum of Comparative Zoology at Harvard University.

Later that month Gilbert returned to the coast, and on 28 November collected a nest of the Western Bristlebird (*Dasyornis longirostris*) about 4 miles (6.4 km) south of Fremantle, on plains near the beach.[33] This, the only nest of this species he managed to find, was large and globular with an entrance on the side, built in a clump of coarse grass about seven inches (18 cm) from the ground. The bird was sitting on two eggs.[34]

The Western Bristlebird, now incredibly rare and confined to a small area around Two Peoples Bay in the Albany area of south-western Western Australia, was described by Gould from Gilbert's specimens, but unfortunately the only collecting date or exact locality that Gilbert recorded in his notes was for the nest. The type specimen appears to have been one of the birds Gilbert sent to Gould on the *Shepherd* in January 1840 (the list of skins included "*1 Salicaria*" and he also sent a skeleton of a "*Salicaria (Djyrdalya)*"), but Gilbert had already mentioned the bird three months before, in his letter of 3 September 1839[35] ("Among the more striking examples of my additions . . . a large Reed Wren like Salicaria").

Gilbert's notes give us detailed information about this "most remarkably shy bird," the "Djyr-dal-ya" of lowland Aborigines, which inhabited reeds and long grass on the edges of rivers and lakes, and which was difficult to see except for the infrequent times that individuals made the effort to fly to a branch to sing; they were poor flyers.

In December 1839 Gilbert paid another visit to Garden and Rottnest islands, where he added considerably to his collections of birds and eggs. On Rottnest he collected specimens of a new parrot, later described by John Gould as *Euphema petrophila* (the Rock Parrot *Neophema petrophila*).[36] Gould based his description on individuals from both South and Western Australia, but stated that the stronghold of the species was Rottnest and the other islands near the mouth of the Swan River. However, a manuscript of Gilbert's includes this rather conflicting passage about the Rock Parrot, suggesting that Gould had read his notes too quickly:

> "[I] saw this bird in no other place but Rottnest Island, where they are tolerably abundant, I have reason to believe they are confined to this Island for on the other islands I visited I only saw the N. venustus [the Western Rosella *Platycercus icterotis*], and the bird is not at all known to the collectors on the Main [land; rest of document missing]."[37]

According to H. C. Whittell (1942, footnote to p. 221), Gilbert's references to other "islands" must mean he also probably visited Garden and Carnac islands, and possibly also Three Sisters Islands (which are about 20 miles (32 km) south of Swan River) at this time. Gilbert then moved back to the mainland and at the turn of the new year was down on the Murray River, about 35 miles (56 km) south of Perth.[38] Meanwhile, on the same day, the *Shepherd* sailed for London with Gilbert's precious collections on board: 175 bird skins, 95 skeletons, 17 mammals, 9 reptiles, 1 fish, and many boxes of insects, shells, eggs, and nests.

On 29 January 1840 John Gilbert left Swan River on the *Caledonia*. In the early part of February the ship reached King George's Sound, on the south coast of Western Australia, where Gilbert and some fellow explorers—Captain Symers of the *Caledonia*, William Nairne Clark (a lawyer in Albany, which was the township of King George's Sound), five other white men, and three Aborigines—spent two weeks on an expedition in the south-west corner while the *Caledonia* remained at anchor. The party visited the Gordon Plains, near Cranbrook, about 60 miles (96 km) inland.[39] This is where Gilbert was totally enthralled by a huge herd of Western Grey Kangaroos (*Macropus fuliginosus*):—his notes were later used by Gould:[40]

> "I have never seen in any part of Australia so large a Herd as I once met with on the Garden [= Gordon] Plains in 1840. There could not have been less than 500 Kangaroos, speaking in the utmost moderation . . . ."

However, the party actually went further inland, reaching the township of Kojonup, where there was an oasis of several pools, frequented by "myriads" of Elegant Parrot (*Neophema elegans*), and where Gilbert also saw Red-capped Robins (*Petroica goodenovii*).[41] Gilbert himself went even further, to "Man-da-lup," before they all returned to King George's Sound.

Gilbert was disappointed with the zoological results of his stay at King George's Sound; the weather had been too dry for good collecting.[42] However, in 1841, John Gould described an important new marsupial that had been collected by Gilbert at the Sound during his visit in February 1840,[43] naming it after his assistant:

> "Hypsiprymnus Gilbertii, Gould. Gilbert's Rat Kangaroo . . . In dedicating it to Mr Gilbert, who proceeded with me to Australia to assist in the objects of my expedition, and who is still prosecuting his researches on the northern portion of that continent, I embrace with pleasure the opportunity thus afforded me of expressing my sense of the great zeal and assiduity he has dis-

> played in the objects of his mission; and as science is indebted to Mr Gilbert for the knowledge of this and several other interesting discoveries, I trust that, however objectionable it may be to name species after individuals, in this instance it will not be deemed inappropriate."

Gilbert knew this animal by its Aboriginal name "Ngil-gyte"; it is now known as Gilbert's Rat Kangaroo or Gilbert's Potoroo (*Potorous gilbertii*), and is a relative of the Long-nosed Potoroo (*P. tridactylus*) of the east coast. After Gilbert's discovery a few more of these little kangaroos were collected in the Albany area, but none was seen after the beginning of the twentieth century; for nearly a hundred years the species was thought to be extinct. Happily, in the early 1990s, Department of Conservation & Land Management (CALM) staff at Two Peoples Bay Nature Reserve in the Sound, who were trapping mammals for scientific study, found a rather unusual occupant of one of their traps. It was a Gilbert's Potoroo. They are still, however, Australia's most critically endangered mammal, and estimates put the wild population at only 40 individuals. A small number have been taken into captivity, where measures are being taken to breed them, although they are proving difficult guests (due in part to their specialist diet of fungi). The importance in status and public regard for Gilbert's Potoroo is indicated by the fact that these little kangaroos now have their own society and website.[44]

The skin of the first Gilbert's Potoroo sailed with John Gilbert on the *Caledonia* from King George's Sound at the beginning of March 1840. The ship and her company (which were joined at Albany by the explorer George Grey and his new wife) stopped at Adelaide, South Australia (where they stayed for three weeks) and then Port Phillip, Victoria (where they stayed for four days). Gilbert in fact visited every one of the present states of Australia. Unfortunately, no museum specimens from Gilbert's time in April 1840 in either South Australia or around Port Phillip (Melbourne) have been located, although it seems unlikely that this indefatigable hunter did not find anything there of interest.

On 3 May the *Caledonia* arrived in Sydney. A letter from Gilbert to Gould, written the following day,[45] does not even attempt to disguise the resentment he felt at discovering that the Gould party had sailed for England without him, just three weeks earlier. Gould had not only decamped, but had left Gilbert conflicting and imprecise instructions, and had not made proper arrangements for the possessions that Gilbert had left with him. On discovering that Gould had gone, Gilbert threw himself on the good mercies of George Bennett, the curator of the Australian Museum in Sydney. It was from Bennett's house that Gilbert wrote this letter to his employer, taking the opportunity to air a few other grievances, such as the fact that Gould had hustled him off to Western Australia without equipping him properly ("what could I not have done with your Bullock Cart, Horses & Men?"). Gilbert also complained that Gould had left him a long list of birds he wanted him to try to collect, but had only given him the scientific names, many of which he did not recognise. Gould hadn't even left Gilbert a decent gun to procure these desirables. To make things worse, Stuart Donaldson, the banker with whom Gould had left credit for his assistant, was cavalier with the working-class Gilbert, being "an upstart & a coxcomb" and treated Gilbert in a most careless and indifferent manner.

THE NORTHERN COAST

The most immediate problem for John Gilbert was what to do next. John Gould, his employer, had not left clear instructions about whether he should follow him back to England, or proceed to another Australian region with good collecting potential. Gilbert had to make the decision for himself. For a time he toyed with the idea of going to New Zealand, but finally decided to visit the inlet of Port Essington, part of the Cobourg Peninsula on the north coast of Australia, where a remote British Naval outpost had been established in 1838 in the interests of trade and sovereignty. Gilbert knew that this area was at that time almost totally unexplored, and imagined it to be teeming with new birds and mammals for him to discover. Eventually he managed to obtain a passage on the *Gilmore*, which was sailing to re-provision the outpost after the losses sustained in a hurricane the previous year.

Gilbert did not spend long adjusting to the subtropical climate of the north coast of Australia after his arrival on 12 July 1840 at Victoria, the little naval colony established at the south-west end of Port Essington, on 12 July 1840. Just four days later he wrote to Gould giving his first impressions of the settlement.[46] Gilbert had arrived to find it in some disarray after the hurricane; the naval contingent had been badly off for provisions and the *Gilmore* was heartily welcomed. As for the wildlife, Gilbert had only been out once and had seen so many beautiful birds that he did not know which to shoot first. The dedicated fieldworker had gone about pitching his tent, but it was so hot that Commandant McArthur[47] arranged for quarters for him in Government House.

Gilbert spent the next month collecting within a short distance of the settlement; his specimens bear locations such as Port Essington, Victoria, Point Record, Mangrove Point, and Pig Lagoons. One of his first new discoveries was a flycatcher, which he mentioned in a letter to Gould dated 19 September 1840:

> "Among the most prominent of my birds, and which are new to me, are . . . a small Brown backed & yellow bellied flycatcher."

Gilbert had collected several individuals, including a male on 21 July 1840. These specimens were the basis of Gould's *Microeca flavigaster*, published in 1843 (Lemon-bellied Flycatcher) (Figure 5). A rather charming indication that Gould often used Gilbert's manuscripts verbatim for his text for *The Birds of Australia* can be seen in Gould's entry for this little flycatcher, listed in his original notes by Gilbert as "Muscicapa (18)."[48] Gould in his usual hurry has scribbled his amendments directly onto Gilbert's notes—thus Gilbert's "In his habits and manners generally, it partakes very much of the Petroica family" is followed by "says Mr Gilbert" as a scrawled Gouldian insert. One can just imagine Gould throwing the whole thing at his long-suffering secretary Edwin Prince to copy out neatly for the printers.

Gilbert's description of the bird gives a lively (if misspelled) image of its habits:

> " . . . sitting a long time stationary, while uttering its very pretty and agreable melody . . . and it regularly soars upward in circles like the skylark . . . at so great a height that it was difficult for the eye to follow; when it again descends, it is perpendicularly till within a very short distance of the trees, when it closes its wings and apparantly falls upon the branch it perches upon . . . ."

Gilbert went on to say that Lemon-bellied Flycatchers were extremely pugnacious, and he had observed a pair beating up and then seeing off a crow. Gilbert found young birds only a few days fledged, but did not succeed in finding a nest.

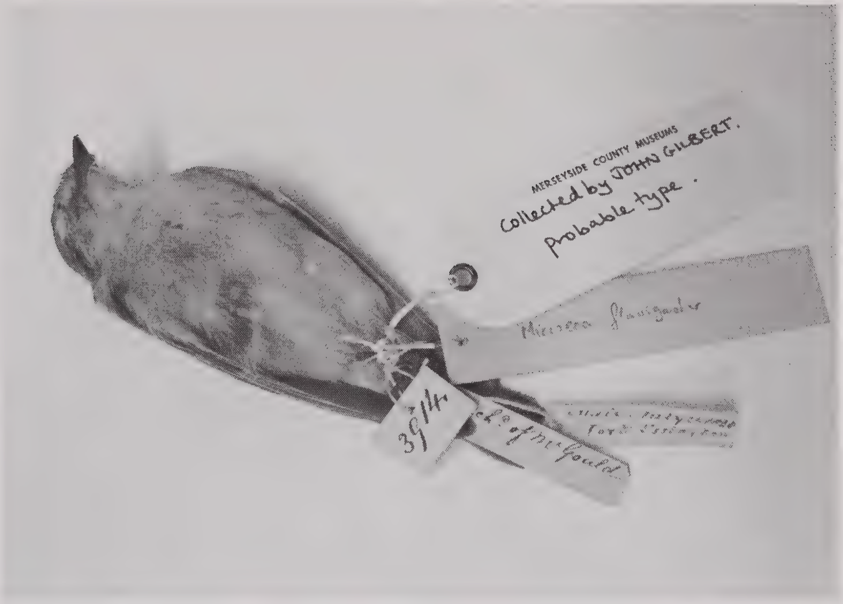

Figure 5. One of Gilbert's first new discoveries at Port Essington was a flycatcher, which he mentioned in a letter to Gould dated 19 September 1840: "Among the most prominent of my birds, and which are new to me, are . . . a small Brown backed & yellow bellied flycatcher." Gilbert collected several individuals of this new bird, including a male on 21st July 1840 (LIVM D.3914s). These specimens were the basis of Gould's name *Microeca flavigaster*, published in 1843 (the Lemon-bellied Flycatcher).

His new discoveries also included the northern form of the Willie Wagtail, considered by some to be a true subspecies *Rhipidura leucophrys picata*; he collected a specimen on the 25 July at Point Record.[49] Gilbert's notes on this wagtail[50] read as follows:

> "This must be considered as a rare bird, and perhaps only an accidental visitor in this part of Australia, untill [sic] my arrival not one had ever been seen or shot since the formation of the settlement, and during my eight months wanderings, I only saw three pair, and all these immediately after my arrival."

In his *Ornithological Notes*[51] Gilbert recorded that the bird was:

> "very like Rhipidura motacilloides [the nominate subspecies of *Rhipidura leucophrys*] but is much less in all its proportions, and

> in its habits and manners much more shy and retired; and may be considered a rare bird on the Cobourg Peninsular [sic]."

In early August 1840 Gilbert also collected the first specimen of a new form of the Little Friarbird, the northern subspecies *Philemon citreogularis sordidus*[52] and discovered three new birds which are now considered full species: two honeyeaters—the Dusky Honeyeater (*Myzomela obscura*)[53] and the Bar-breasted Honeyeater (*Ramsayornis fasciata*)—and the Masked Finch (*Poephila personata*).[54] In relation to the Bar-breasted Honeyeater Gilbert noted that:

> " . . . I believe this species is not at all abundant in any part of the Peninsular [sic], I first saw it, near the Main Land, on the neck, and only once saw a small family, near the Settlement . . . In both instances that I saw it were in families of about twelve."[55]

Later in August of 1840 Gilbert took the opportunity to go on a week's exploratory cruise in a large "Deck Boat" which visited the islands in Van Diemens Gulf,[56] on the south side of the Cobourg Peninsula. The islands where Gilbert managed to get ashore included Mayday (now called Morse Island, to avoid misinterpretation of radio signals), where he discovered yet another new honeyeater, named *Entomophila albogularis* by Gould in 1843[57] and now known as *Conopophila albogularis*, the Rufous-banded Honeyeater.

On Greenhill Island Gilbert collected specimens of two spectacular new birds. The first were of a pretty little citrine-green and lemon yellow insect-eater, now known as the Yellow White-eye (*Zosterops luteus*).[58] Gilbert also obtained specimens of a new finch, which was later named by Gould (supposedly) after his "late and lamented" wife Elizabeth, née Coxen (who had died in 1841 after giving birth to their eighth child)—the Gouldian Finch (*Erythrura gouldiae*) (Figure 6). Benjamin Bynoe, Surgeon of H.M.S. *Beagle*, had already collected an adult male Gouldian Finch at the Victoria River but Gilbert found immature birds on Greenhill Island,[59] which indicated they were breeding there. Gilbert made no mention of the plumage of the birds he had collected in his notes for Gould,[60] but in both these accounts he goes into some detail about:

> "Three excrescences on each gape, about the size of the head of a moderate sized pin, the upper and lower, bright indigo blue, the

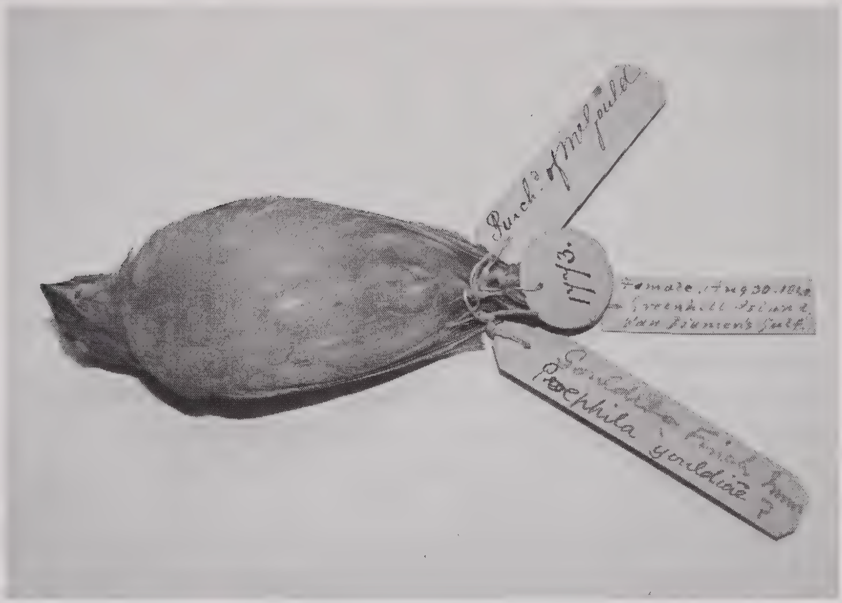

Figure 6. Benjamin Bynoe had already collected the male type of the Gouldian Finch (which John Gould named after his "late and lamented" wife Elizabeth) at the Victoria River, but Gilbert's immature and female specimens from Van Diemens Gulf are also part of Gould's type series for the name *Erythrura gouldiae*. One of these is now in National Museums Liverpool, an immature female collected by John Gilbert on Greenhill Island on 30 August 1840 (D. 1773).

> middle one very pale yellow, on the roof of the mouth fine small spots of purple, form a crescent, across to each gape . . . ."

Gilbert called the bird the "Spotted Mouth Finch" and also said that he had only found the birds in one spot, namely Greenhill Island, where they inhabited the edges of mangroves, or small gum trees.

By 5 September, the dates on two juvenile Pied Oystercatchers (*Haematopus longirostris*) he had collected,[61] Gilbert had returned to the inlet of Port Essington. On 19 September 1840 he wrote to his employer.[62] Gilbert had already collected 200 specimens from 90 species of birds, with eggs and skeletons, and also had a fine collection of insects and a few plants, reptiles, and fish. He had only managed to collect specimens of three mammals, the dearth of which he put down to the after effects of the hurricane the previous year, which must have stripped much of the vegetative cover on the Cobourg Peninsula.[63] Gilbert was especially proud of the fact that he had made one trip in the interior for ten days, going several miles farther than any European had done previously. However, the heat was a problem, bringing on "such a degree of lasitude [sic] and weakness that I have now adopted the plan of going out by the dawn of day, and the cool of the evening." Even worse were the ants:

> " . . . you have no idea of the difficulty I find in keeping my collection free from the Ants, which so abound here, many of my specimens have been completely destroyed by them in a single night, so that as fast as they dry I am obliged to paste them up in Boxes."

Between the end of September and a date before the beginning of November 1840, John Gilbert visited the island of Timor. There is no mention of his intention in his September letter to Gould, the last that seems to exist from Gilbert's Port Essington stay. As with Gilbert's third excursion to York in Western Australia in November 1839, the main proof of his trip to Timor are the data labels on specimens now in the National Museums Liverpool.[64] According to Captain Chambers (master of the *Pelorus*), Gilbert went to Timor with John Armstrong—the Victoria settlement's gardener and botanical collector—on the English schooner *Lulworth*. She made several trips between Copang (= Kupang, the main city of Timor) and Victoria, Port Essington, with buffaloes for the colony.

By 13 November, Gilbert was back at Port Essington, specifically at the King's River where he found a nestling of the Large-tailed Nightjar (*Caprimulgus macrurus*) "lying upon the ground without any nest or even a blade of grass near it." He appears to have concentrated on nearby localities, or ones easily reached by boat, for the remainder of his stay in the colony.[65] However, during the months of November and December Gilbert collected specimens of two more new birds: the northern subspecies of the Striated Heron (*Butorides striatus stagnatilis*) and the Australasian subspecies of the Wandering Whistling-Duck (*Dendrocygna arcuata australis*).[66]

Gilbert had found a colony of the Striated Herons breeding on two small islets in Coral Bay, near the entrance to the harbour of Port Essington. Their nests, of which there were about 30, were built in mangroves and in *Hibiscus* trees; they were frail structures and none was more than six feet (2 m) from the ground. As for the whistling-ducks—that Gilbert listed as "(105) . . . En-jep-ere ... Al-ler-gid-o*?*"—they were visitors to the lakes near the harbour in the latter part of the dry season, when the water was low. In December [1840] Gilbert saw Wandering Whistling-Ducks in "immense" flocks in company with Radjah Shelduck (*Tadorna radjah*), but when he shot at them each species formed its own distinct flock, which then rose as one. The Wandering Whistling-Duck appeared to be silent, except for the peculiar whistle, which was heard constantly while the duck was in flight.

On 14 January 1841 Gilbert was at Table Head River, where he found at least twenty nests of the Pied Imperial-Pigeon (*Ducula bicolor*).[67] Over the next two months he discovered at least another four new birds; the Green Pygmy-goose (*Nettapus pulchellus*), the Peaceful Dove (*Geopelia placida*), a subspecies of the Little Shrike-thrush (*Colluricincla megarhyncha parvula*) and the White-gaped Honeyeater (*Lichenostomus unicolor*).[68] He shot two Green Pygmy-geese (the "Loon-byte") . . . "while they were swimming on a quiet secluded lake." They were:

> "beautiful birds . . . are certainly a rare bird on the Peninsular [sic] . . . It is an extremely shy bird, at the slightest movement of any thing near it, it dives and remains under water a long time; the Female I killed on the 16 Jan, contained an egg nearly ready for laying. The nest I found, which was built up in the long grass about a foot above the water."[69]

As for the Little Shrike-thrush, Gould also used Gilbert's observations, which referred to the shyness and wariness of the bird, an inhabitant of thickets and with a loud clear rich whistling note, in his published accounts.[70] Gilbert found a nest on the hollow part of a dead branch, about four feet (1.3 m) from the ground; he said that the nest—like that of the Grey Shrike-thrush (*Colluricincla harmonica*)—was made of small twigs and the soft bark of paperbarks (*Melaleuca*). Gilbert also described the egg, of which he found two. It is possible that a single egg from Port Essington of this secretive rainforest bird, now in the Tring collections,[71] is one of these.

Gilbert collected other new birds during his nine-month stay at Port Essington, but for some of these we cannot be sure about the date when they were first collected, nor the exact locality. Probably the most significant of these was the northern Australian form of Orange-footed Scrubfowl (*Megapodius reinwardt tumulus*). Gilbert was fascinated by the bird, as he had been by another mound-builder he discovered on his visit to Western Australia, the Malleefowl (*Leipoa ocellata*). He therefore wrote pages of notes under his entries for both these great ornithological engineers, and his descriptions provide an opportunity to show just how perceptive Gilbert was as a field naturalist, and also the high standard of his prose—especially for someone who begged forgiveness for his "want of Education."[72] We do know that Gilbert first collected specimens of this new scrubfowl between the months of July (when he arrived) and September 1840, as he mentioned the bird in a letter sent to Gould from Port Essington on 19 September 1840:[73]

> "Among the most prominent of my new birds, and which are new to me, are . . . a Gallinaceous Bird termed here "the Jungle Fowl," crested, and something of the form of an Indian genus, but having short powerful legs and long claws of immense strength."

Gilbert gave precise details about his hunt for this scrubfowl and the facts he discovered about the mounds they made. He went to Knocker's Bay, on 16 November 1840, with a particular Aborigine who had shown aptitude in locating birds. Just a few feet above the high water mark, Gilbert found a mound of sand and shells about twenty feet in circumference and about five feet tall. On scrambling up the mound, he found a bird in a hole about two feet deep, it was only a few days old. Gilbert tried to keep the bird in captivity, but it proved intractable and escaped on the third day; in the meantime he became fascinated with the speed it could hurl sand from one end of its box to the other, and irritated with the noise it made in doing so all night.

The mounds at Knocker's Bay continued to yield eggs up to 6 February 1841, when Gilbert was able to return there himself and see the Aborigines retrieve two eggs which were six foot (1.8 m) deep into the mound. On 10 February he made another visit to Knocker's Bay and on this occasion discovered a huge mound measuring fifteen feet (4.6 m) in height and over sixty feet (18.3 m) in circumference. It was obvious that some of the mounds were ancient structures used by succeeding generations of scrubfowls, who appeared to lay eggs in the mounds between August and March—giving a non-laying interval of only four or five months.

All these notes of Gilbert's concerning Knockers' Bay were included in Gould's account in *The Birds of Australia*, but there were other location details which Gould did not publish. Gilbert's *Ornithological Notes* add information on sightings of the scrubfowl he made on some of the islands in Van Diemens Gulf, much more detail about the behaviour of the birds, and some comments on problems with predation by Dingoes (*Canis lupus dingo*) and carnivorous marsupials. Gould also left out a salutary little tale about how Gilbert's Aboriginal assistant had become firmly lodged in one of the holes he was excavating in order to retrieve eggs, and was only rescued from rather a macabre death by Gilbert hauling strongly on his legs.

It is also worth noting that John Gilbert's particular interest in scrubfowls may be why the scrubfowl *Megapodius gilbertii,* described by the British Museum bird curator George Gray in 1861 from Alfred Wallace specimens from the Celebes (Sulawesi), seems to have been named after him.[74]

No specimens appear to have been collected in the period between 11 February and 17 March 1841, the date Gilbert left for England. Presumably he would have been busy preparing and packing the specimens he already had.

John Gilbert left Port Essington, and Australia, on the brig *Pelorus*, extensively repaired after having been badly damaged in the hurricane of the year before. They sailed for Singapore (via Timor), arriving in April 1841. There Gilbert transhipped to the barque *Thomas Harrison* for London, arriving in "happy old England"[75] on 30 September 1841.

GILBERT RETURNS DOWN UNDER

Very little is known about what Gilbert did in the period between his two trips to Australia, but he was probably working for Gould. At least one collection of birds (the Muller collection from New Guinea), which was labelled by Gilbert, must have been dealt with during this period. It also seems likely that all the heavily-detailed species sheets now in Cambridge University Library, which were used by Gould as notes for the text of his eight-volume *The Birds of Australia,* were transcribed by Gilbert from his field notebooks during this period. Gilbert also must have used this time to put together his two volumes of *Ornithological Notes* and his little notebook on marsupials, which are now in Queensland Museum Library. However, Gilbert was in England for barely four months before taking ship again for Australia.

On 31 January 1842, John Gould and John Gilbert signed an agreement covering Gilbert's second trip to Australia (MLS). In this document John Gould praised his assistant for the excellent results of the first:

> "Few expeditions . . . have terminated so happily as our own, and certainly none have been productive of so large a number of novelties in the field of science or of so many singular facts relative to the economy of the subjects discovered as our joint expeditions have been . . . ."[76]

The reasons for Gould sending his assistant back to Australia were two fold: to continue collecting, and to drum up subscribers for Gould's published works.

On 2 February 1842 Gilbert left London on the brig *Houghton-le-Skerne* via the Cape of Good Hope, where the vessel apparently stayed for five weeks. The ship was "The strangest vessel and the oddest people to manage her I have yet seen" with soup brought to the table in a "common yellow pie dish" by the Captain's wife, who smoked a pipe (which put Gilbert completely off the pastries she made).[77] However, Gilbert felt "in excellent spirits, dreaming every night of Kangaroo's and Native Pheasants."

On 17 July 1842, Gilbert arrived again at Fremantle.[78] He went straight to work on behalf of his employer—on 20 July he published an advertisement for Gould's *The Birds of Australia* in the Western Australian *Inquirer*. Gilbert then left for the interior, anxious to see his friend James Drummond and to set up a collecting system for mammals, the group he felt needed the most attention.

Throughout August Gilbert was collecting in his old localities of the Avon River, Toodyay Valley, and Northam.[79] Later in that month Gilbert and James Drummond left the Drummonds' home, Hawthornden, in the Toodyay Valley for the Moore River to the north, a trip that was of great value from both the botanical and zoological points of view.[80] They travelled via the outlying homesteads and settlements of Bolgart (the homestead of Captain Scully, the Government Resident of the Toodyay district), Yoolgan, Yeinart, and Badgee Badgee and eventually reached the Drummonds' permanent station at Moerin, near New Norcia, on the Moore River. Gilbert and Drummond then continued northwards across the Victoria Plains, past the spring at Boorbarna and Moora, to the fresh water lakes of Dalarn and Maradine (the Dalaroo Lakes), where Gilbert shot many ducks and "water hens."

Returning to Moerin by a different route through "splendid grassy country," Gilbert collected his first specimen of the Grey Falcon (*Falco hypoleucos*), which Gould had described in 1841 from an individual given to Gilbert by a Mr. Lock Burgess during his first visit to Western Australia. Gilbert thought his new individual differed from the bird of Gould's published plate (*The Birds of Australia* 1840-1848, vol.1, plate 7) in that it was a uniform ash grey all over, and when first killed had a "meally-like appearance" he had not seen before. He was captivated:

> "I assure you I never gazed with more delight on any Specimen I ever Shot, than on this Bird, as it lay on the grass, throwing up its feet to prevent my hand reaching it, the rich orange-yellow of the whole of the Face, & Legs contrasting beautifully with its delicate plumage. To sum up all, it was one of the most beautiful Birds I ever gazed upon."[81]

At the beginning of September, the pair retraced their steps to the Moore River and the station at Moerin, where Gilbert set his traps and successfully caught specimens of a beautiful new species of mouse, "Jeit-Vitch" of the Aborigines, later described as *Mus nanus* by John Gould.[82]

Drummond and Gilbert then returned south to Hawthornden. Gilbert collected a specimen of the now rare Numbat (*Myrmecobius fasciatus*)—the attractively striped, anteating marsupial which is the emblem of Western Australia—at Toodyay on 6 September,[83] but by the 13th they were back in Perth to re-provision, leave their accumulated collections and collect their mail. Here Gilbert began a long, serial letter to Gould,[84] in which he first related the tale of the trip to the Moore River. The letter was put to one side, to be continued later with a description of their next excursion, even further east—to the Wongan Hills, called "Wongan Catta" by the Aborigines.

Both James Drummond and his son Johnston joined Gilbert on this expedition, which was made specifically to look at the nests of Malleefowl, although the party also made important botanical collections.[85] They travelled via Northam,[86] Wattening, and over the "Gwangra Plains" to "Barnarning," about 10 miles (16 km) from the Wongan Hills, but for a week from about 20 September Gilbert and the

Drummonds returned to their old collecting sites at the Moore River. Gilbert focused on kangaroos, and obtained a fine series of Western Grey Kangaroos, such as a "Flying Doe, of the second year with her first young one . . ." which was collected on the 24th. On the 28th they were nearing the Wongan Hills, which they finally reached after forcing their way through "an almost impenetrable Scrub" with water so bad their horses would not drink it.[87]

The Wongan Hills are a range of ironstone hills, surrounded by dense thicket and to the east of the Moore River, and which are now known unofficially as "The Gilbert Country." The hills were noted for their Malleefowl nests and Gilbert was tremendously excited by his first sight of eggs actually inside a mound, in his haste throwing aside the Aborigine who was with them. The man indignantly stopped Gilbert before he broke the eggs, and showed him how to scrape off the earth carefully from the centre, forming a basin from which the eggs protruded. The largest mound Gilbert saw was forty-five feet (13.7 m) in circumference and about five feet (1.5 m) in height. They saw many

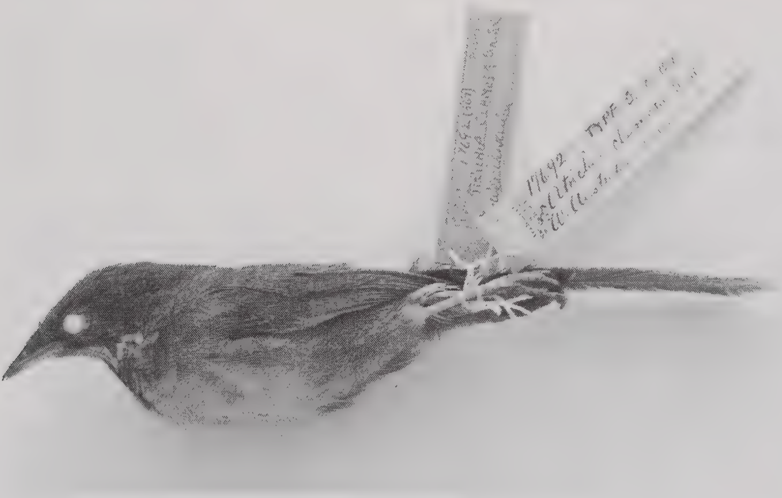

Figure 7. Gilbert's first specimen of the rare and elusive Noisy Scrub-bird was collected near Drakesbrook in Western Australia in November 1842, and is probably the male from "Western Australia" now in the Academy of Natural Sciences, Philadelphia (ANSP 17692). In 1844 Gould named the new species *Atrichornis clamosus* from Gilbert's specimens. © Vireo, Academy of Natural Sciences, Philadelphia.

Malleefowl tracks, but there was no sign of the birds themselves. Gilbert tried to obtain a specimen of an adult in vain, despite crouching in the twilight behind a bush near one of the mounds until he could scarcely endure the pain in his limbs. They then lost their way in the two miles (3.2 km) of merciless thicket between the *Leipoa* mounds and their campsite, finally arriving exhausted and with torn clothes and scratched limbs and face.

The Drummonds, having collected all the botanical specimens they wanted, and weary of the thickets of the Wongan Hills, could not be persuaded to continue to explore the area, or go any further to the east with Gilbert. The party therefore returned to the Perth area, where Gilbert went straight back into the field and discovered another new small rodent, the Ash-grey Mouse (*Pseudomys albocinereus*).[88] He also collected a male Rufous Treecreeper (*Climacteris rufa*), which is one of the few Gilbert specimens in the collections of an Australian museum, albeit by an extremely circuitous route.[89]

Gilbert and the two Drummonds next decided to attempt an overland trip to King George's Sound, in the remote south-west, where Gilbert had stopped off on his voyage from Perth to Sydney in February 1840.[90] They set out on 24 October 1842, accompanied by a Glaswegian called Scott, and travelled via Fremantle and then south, just inland from the coast past the chain of offshore islands. They camped for the night of the 25th at Warrangelup Flat on the Serpentine River. The next day they reached Ravenswood on the Murray, the residence of Adam Armstrong.[91] It rained solidly for five days so they collected in the immediate area, and visited a farm on the Dandalup River, a tributary of the Murray. On 1 November the party set off for Mount William, managing 13 miles (20.9 km) along the Murray, but an accident befell their pack horse and they had to send her back to Pinjarra with Mr. Scott. They then continued along the Murray, through the Darling Ranges to Drakesbrook (near the present town of Waroona), where on 3 November Gilbert made a momentous discovery.

A bronze plaque, erected at Drakesbrook by the Royal Australasian Ornithologists' Union and the Western Australian Historical Society on 12 September 1948, commemorates this event, for it was here that Gilbert collected his first specimen of that most rare and interesting of birds, the Noisy Scrub-bird (*Atrichornis clamosus*) (Figure 7). The plaque reads:

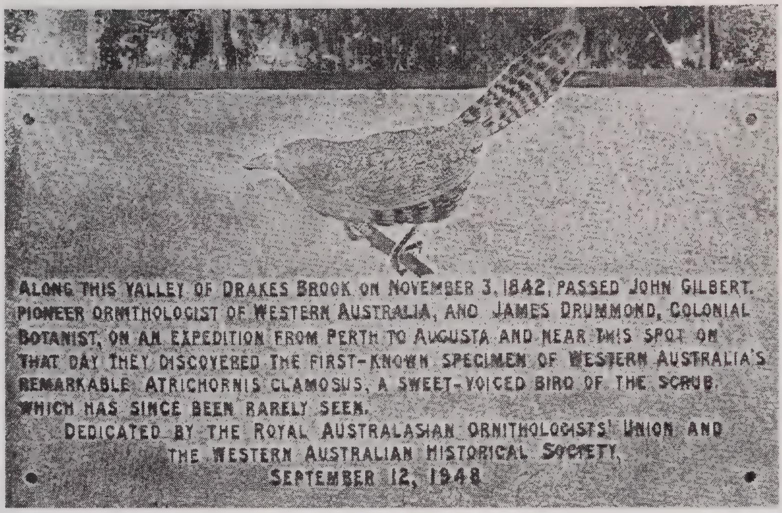
ALONG THIS VALLEY OF DRAKES BROOK ON NOVEMBER 3, 1842, PASSED JOHN GILBERT,
PIONEER ORNITHOLOGIST OF WESTERN AUSTRALIA, AND JAMES DRUMMOND, COLONIAL
BOTANIST, ON AN EXPEDITION FROM PERTH TO AUGUSTA AND NEAR THIS SPOT ON
THAT DAY THEY DISCOVERED THE FIRST-KNOWN SPECIMEN OF WESTERN AUSTRALIA'S
REMARKABLE ATRICHORNIS CLAMOSUS, A SWEET-VOICED BIRD OF THE SCRUB,
WHICH HAS SINCE BEEN RARELY SEEN.
DEDICATED BY THE ROYAL AUSTRALASIAN ORNITHOLOGISTS' UNION AND
THE WESTERN AUSTRALIAN HISTORICAL SOCIETY,
SEPTEMBER 12, 1948

Figure 8. Memorial to Gilbert's discovery of the Noisy Scrub-bird in November 1842, erected at Drakesbook, near Waroona, by the Royal Australasian Ornithologists' Union and the Western Australian Historical Society in September, 1948.

> "Along this valley of Drakesbrook on November 3, 1842 passed John Gilbert, pioneer ornithologist of Western Australia, and James Drummond, Colonial Botanist, on an expedition from Perth to Augusta and near this spot on that day they discovered the first-known specimen of Western Australia's remarkable Atrichornis clamosus, a sweet-voiced bird of the scrub, which has since been rarely seen" (Figure 8).

Gilbert's first specimen is probably the male from "Western Australia" now in the Academy of Natural Sciences, Philadelphia (ANSP 17692, see figure 7), although another Gilbert bird with this locality is now in Harvard University.[92] One can only admire Gilbert's doggedness in collecting at least seven of these impossibly retiring birds, which skulk in the undergrowth and rarely fly. He made copious notes about the Noisy Scrub-bird for John Gould, including a long passage in a letter he sent Gould on 2 January 1843:

> " . . . the whole of the upper side dark reddish brown, each feather from the nape downwards, wings & tail beautifully barred with zigzag bands of black, throat and sides of neck white . . . the legs

> are very robust, in fact the whole body of the bird has the osteological characters carried out to extreme strength; this is without exception the loudest of all the Western Australian songsters I have yet heard. It inhabits the densest and rankest vegetation, on the sides of hills and thick swamp grass on the banks of small running streams or swamps, and is of all birds, the most difficult I have yet had to procure, it is in fact but a mere chance the seeing the bird at all, it runs with the utmost rapidity on the ground perfectly sheltered from view by the overhanging vegetation, which renders it almost impossible to get a shot at it, for it is seldom indeed that it trusts to its wings for progression. When I first heard its extraordinary loud melodious note, I was perfectly convinced it proceeded from a bird never before seen by me, and I was tantalised still more, by watching and waiting in vain for hours together, in creeping quietly through the bush, I have frequently been as I imagined within a yard of the bird, while its loud but pleasing note fairly made my ears ring, and yet I could not see the creature, no bird in fact that I have yet met with has cost me so much time and patience" (LCL).

In fact he had only managed to collect four specimens, two of which he had nearly blown to pieces, as he had been almost on top of the birds before he had actually seen them.[93]

Gilbert reported that his new bird was locally abundant, and he heard it singing at Cape Leeuwin, but sadly this shy little bird with the great big voice does not exist in the Drakesbrook area any more, and indeed for many years was thought to be extinct. It was rediscovered in Two Peoples Bay, near Albany in King George's Sound, in 1961, but is confined to this area and still desperately rare, although small groups of birds have been relocated to other sites in order to expand its range.

Gilbert also collected a female White-breasted Robin (*Eopsaltria georgiana*) in the Darling Ranges, on 4 November 1842. This bird of dense thickets is localised, having two disassociated populations, one north of Perth. Gilbert's bird was from the southern population, which occurs in the south-west corner from Busselton to King George's Sound. He collected another individual, a male, at the Vasse River on 25 November.[94]

The party continued south-east and on 5 November 1842, reached Mount William, but they found the going difficult and decided to return to their provisions depot at Pinjarra, and thence strike more directly south along the coast to Australind instead of trying to get south-eastwards to King George's Sound directly. Over the next week or so Gilbert and the Drummonds made considerable collections in the country between Pinjarra and the Vasse River in the Busselton area. They left these at the residence of Captain John Molloy at "Fairlawn" and set out south again, for Augusta.

Entries for 21 November and 24 December 1842 in the diary of Archdeacon Wollaston of Picton (Bunbury) indicate that Gilbert and Drummond passed him, going out and then returning, on those dates.[95] On the return journey they were somewhat downhearted, as they had been unable to break through the scrub between Augusta and King George's Sound, but the clergyman was shown some interesting specimens. According to Drummond they had been "defeated by the impossibility of getting over the Scot River and the swampy district in which it rises." The "road" from the Vasse to Augusta had been bad enough, being a "mere footpath" which "crosses many swampy valleys with streams of water, some of them . . . of considerable size."[96]

Gilbert and the Drummonds had managed to get as far as Cape Leeuwin, just south of Augusta. They visited the islands offshore, where Gilbert made copious notes on seabirds. Some of these were later put into his letters to Gould, who used them in his publications—particularly in the *Handbook of Australian Birds.* Several specimens survive from Gilbert's time at Cape Leeuwin, including a pair of Rock Parrots, stocky little birds adapted to salty sea-side conditions, which Gilbert collected on an "Island off Cape Lewin" on 6 December 1842.[97] Here he was also "fortunate enough to find a [new] species of Mutton-bird," collecting specimens from which John Gould described the new species *Puffinus carneipes* in 1844.[98] This was the Flesh-footed Shearwater, which has a population that breeds on the islands off the south-west coast of Australia—it might seem rather odd that this sea-bird had not been collected and described before, but shearwaters and petrels would have been difficult to shoot and retrieve while at sea, and Gilbert must have seized the chance to collect nesting birds.

Gilbert also obtained specimens of:

> "a very beautiful small species of Petrel . . . the darker colour of the back, wings and tail are all inclined to greyish, the whole of the under side is pure white, grey head & nape, and a white fore-

> head, with a white stripe running down over and behind the eye . . . they lay but a single egg, in a small hole varying from two to four feet [1.2 m] in length, and form a[s] flooring a loose nest of the leaves of a species of Geranium growing abundantly on the island."

These were probably individuals of the White-faced Storm-Petrel (*Pelagodroma marina* (Latham)).[99]

Gilbert and Drummond returned north via Bunbury to Perth,[100] but, while he was in Augusta, Gilbert had heard that the remains of the *Ocean Queen*, which had been wrecked on the notoriously dangerous islands of Houtman's Abrolhos, had been purchased by a Captain Scott of Fremantle and he was sending boats out to the islands to salvage her cargo. The Houtman's Abrolhos are a group of small rocky islands off the west coast some distance north of Perth; their name (given by Dutch sea captain Frederick de Houtman in 1619) is a version of the Portugese "abra os olhos" ("Keep your eyes open!")—rather appropriate given their long established reputation for shipwreck, mutiny, piracy, and even cannibalism.[101] Gilbert sailed on the *Perseverance* from Fremantle, bound for the Houtman's Abrolhos, on 6 January 1843, four days after posting his letter "No 7" to Gould. They arrived at the most easterly of the group, Hummock Island, on the 8th, and went ashore on South Island (Pelsaert Island, the largest of the Pelsaert group at 10 miles (16.1 km) long, but narrow in width) the next day.[102] The stormy islands lived up to their reputation and the party was unable to return until the beginning of March, having nearly been shipwrecked themselves in the process. As Gilbert wrote in a letter to Gould:[103]

> "I was there nearly two Months, a much longer period that I had calculated upon, but the Weather was so bad, we could not get back, &, as it was, we ran a very narrow escape, being hove to in a Gale of Wind for four Days, out of sight of Land the greater part of the time, & this in a small 15 ton Boat, we were all given up for lost, & another Boat was sent to look after us, but we missed seeing her, & arrived in Freemantle [sic] first, all safe; as you will see by the Collection I collected in every Branch; on the whole I consider it was a fine collection. I obtained no less [than] thirty Skins of the Wallaby, & I have one alive, which I hope will eventually reach England to enrich the Zoological Society's Gardens. I also obtained a fine Series of Seals."[104]

Gilbert made extensive and interesting collections of birds as well as kangaroos and seals, and his enforced stay allowed him to visit Mangrove Island and East and West Wallaby islands, as well as South Island. He collected specimens of a form of White-browed Scrubwren (*Sericornis frontalis balstoni*), which was not formally described until 1909 by Ogilvie-Grant. In fact Gilbert had mused about whether they were a new species.[105] He saw Silvereyes of the race *Zosterops lateralis chloronotus* (a form which Gould had described from specimens Gilbert had collected on his first trip to Western Australia) distributed "over the whole of the Houtman's Abrolhos, wherever there was the slightest Vegetation, generally feeding in small families on the low and thin samphire Scrub." He found button-quails on both West and East Wallaby islands, inhabiting craggy limestone areas. Gilbert's specimens of this delicately patterned little gamebird were later used by Gould for his description of *Hemipodius scintillans*, now thought to be a valid subspecies, confined to the Houtman's Albrolhos Islands, of the Painted Button-quail (*Turnix varia*).[106]

There were many terns nesting in great numbers. Gilbert included a list of the terns and noddies of the Houtman's Abrolhos in his letter to Gould: " . . . Sterna caspia; poliocerca; Panayensis; minuta; red bill; fuliginosa; Anous stolidus; Lesser Noddy . . ." (Caspian *Sterna caspia*, Crested *S. bergii*, Bridled *S. anaethetus*, Fairy *S. nereis*—which replaces the Little Tern *S. albifrons* around the southern and western coasts—Roseate *S. dougallii* and Sooty terns *S. fuscata*, and Common *Anous stolidus* and Lesser *A. tenuirostris* noddies) and also went into great detail about their nesting habits. John Gould described two new species from Gilbert's specimens of these terns. One of his names, *Sterna gracilis*, is now used for the Australian subspecies of the Roseate Tern, *Sterna dougallii gracilis.*[107] This was the "red bill" of Gilbert's list, also included as the "Redbilled Tern" elsewhere in Gilbert's letter. He said he had killed this tern for the first time on the Houtman's Abrolhos. It was a species which also frequented the coral ridges, sitting there in large flocks during the heat of the day, but he added that the birds had finished nesting by the time he got to the islands—comments that Gould included in the text for his *The Birds of Australia*.[108]

The other new form of tern described by Gould, *Onychoprion fuliginosus*, is now considered to be a synonym of the Australian subspecies of Sooty Tern (*Sterna fuscata serrata* Wagler, 1831).[109] Gilbert found this tern in great numbers on the southern end of South Island, congregated in a noisy gathering and busy laying their variably coloured single egg on the bare ground beneath thick scrub. A few pairs of Fairy Terns also nested on South Island, making small hollows amongst the loose ridges of corals in which to lay their eggs. “Sterna Panayensis” (the Bridled Tern) bred solitarily in pairs, laying their single egg in the fissure of a rock close to the water’s edge, without any attempt at a nest.

Gilbert also collected specimens of the Common Noddy subspecies *Anous stolidus pileatus* on South Island,[110] where they bred in huge numbers. The seamen who took Gilbert to the islands told him that they harvested huge numbers of the eggs, but as soon as they had cleared a space the noddies would re-lay. Their nests were of seaweed liberally plastered with droppings, built on the ground or on thick scrub, often next to nests of Sooty Terns; it was difficult to walk amongst the nests without stepping on either the birds or their eggs. The size of this huge nursery was regulated by a species of lizard,[111] which Gilbert reckoned destroyed 19 out of every 20 individuals, eating eggs and

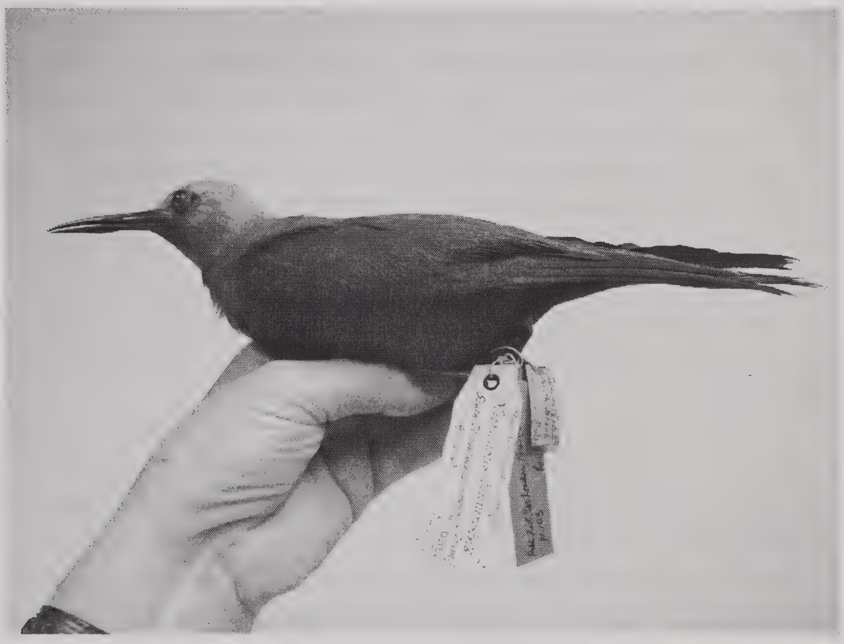

Figure 9. Gould described a new subspecies of the Lesser Noddy, *Anous tenuirostris melanops*, from Gilbert’s Houtman’s Abrolhos collections. Two of Gilbert’s specimens are now in the Liverpool collections, one being a mount (LIVM D.3409a).

fledglings and being particularly partial to the brains and marrow of adult birds. The rest of the carnage was cleaned up by "*Dermestes lardarius*" (the Larder Beetle, the scourge of all museum curators), present in such huge numbers that Gilbert feared for his collections. The Common Noddies were heavy fliers who did not seem to go far out to sea to feed.

John Gould also described a new noddy from Gilbert's Houtman's Abrolhos collections, *Anous melanops*, a name now given to the Australian subspecies of the Lesser Noddy (*Anous tenuirostris melanops*)[112] (Figure 9). Included in Gilbert's long letter of 27 March 1843 is a passage about these noddies, which built nests of seaweed in a gregarious manner in the branches of mangroves, throwing fronds around in an apparently random manner until enough were lying across the branches to form platforms. These were white-topped with excrement, which gave off "a most disagreeable and sickly smell." Like the Common Noddy, Lesser Noddies only occurred on South Island, but in such numbers as to form clouds as they flew back and forth to their feeding grounds outside the reefs:

> "Even Audubon, I think, who has been so accustomed to see such vast flocks of Passenger Pigeons [*Ectopistes migratorius*], could hardly avoid expressing strong Surprise, if he saw these Birds at Sunset, moving in one immense Mass over & around their roosting Places while the noise, from the old Birds quack & the young ones piping whistle is almost deafening."

These birds were favourite articles of food for human visitors, killed in their hundreds every day, but even so they existed in greater numbers than other terns and noddies (which could be attributed to the inability of the resident lizards to climb the mangroves).

Gilbert concluded his long letter to Gould with an account of the Wedge-tailed Shearwater (*Puffinus pacificus*), which he had found inhabiting West Wallaby Island in particular, where there was sand for the birds to excavate their nests.[113] In fact:

> "there being scarcely an inch of ground that is not burrowed by them, and it afforded us a good deal of amusement and laborious walking to cross any part of the island, for it was almost impossible to walk without sinking at nearly every step we took up to the knees."[114]

On an islet south of the Wallaby Islands Gilbert found the "beautiful" White-faced Storm-Petrel, which he had first seen at Cape Leeuwin.[115] At the end of Gilbert's letter he has usefully listed "all the Birds I observed on the Houtman's Abrolhos."

A last excitement was a comet that Gilbert's party saw on the night of 1 March, before they left the islands on a boat that must have been laden with all of Gilbert's specimens, as well as a live Tammar Wallaby, which he intended to send back to England. They apparently reached Fremantle on 17 March,[116] and had certainly returned to the mainland by 27 March, the date on Gilbert's long letter No. 9 to Gould. On 17 April Gilbert wrote a letter about his visit to the Houtman's Abrolhos that was printed in the *Inquirer*.

On 18 April Gilbert again wrote to Gould from Perth.[117] This letter mainly concerned the important collection of mammals which he had made during his second visit to Western Australia; he had obtained several specimens—such as individuals of the south-western subspecies of the Banded Hare Wallaby (*Lagostrophus fasciatus albipilis*), the Wurrung or Crescent Nailtail Wallaby, and the endearingly weird Pig-footed Bandicoot (*Chaeropus ecaudatus*)—from forms that are now extinct.[118]

In May and June 1843, Gilbert was at King George's Sound.[119] He had obviously succeeded finally in getting back to this most important locality, which has a high proportion of animals that are now extinct or extremely rare, for the first time since February 1840 (during his first visit to Western Australia). However, he probably reached it by sea rather than attempting again to reach it overland from Perth. Here, in early June, Gilbert collected more specimens of two avian rarities, the Noisy Scrub-bird and Western Bristlebird (*Dasyornis longirostris*), and at least one more specimen of the equally rare Gilbert's Rat-kangaroo.[120]

Gilbert returned to the Swan River Colony and for the rest of the year travelled again to his favourite interior sites of York, Toodyay, and the Wongan Hills. At the Moore River, on 3 July, Gilbert collected specimens of the now famous, and extremely rare, little carnivorous marsupial—the Southern Dibbler (*Parantechinus apicalis*). Four days later he collected a hopping mouse, of a species which Gould later described as *Hapalotis longicaudata*. Sadly, this, the Long-tailed Hopping-mouse *Notomys longicaudatus*, is no more—yet another small mammal of the Australian fauna which has become extinct since Gilbert's time.[121]

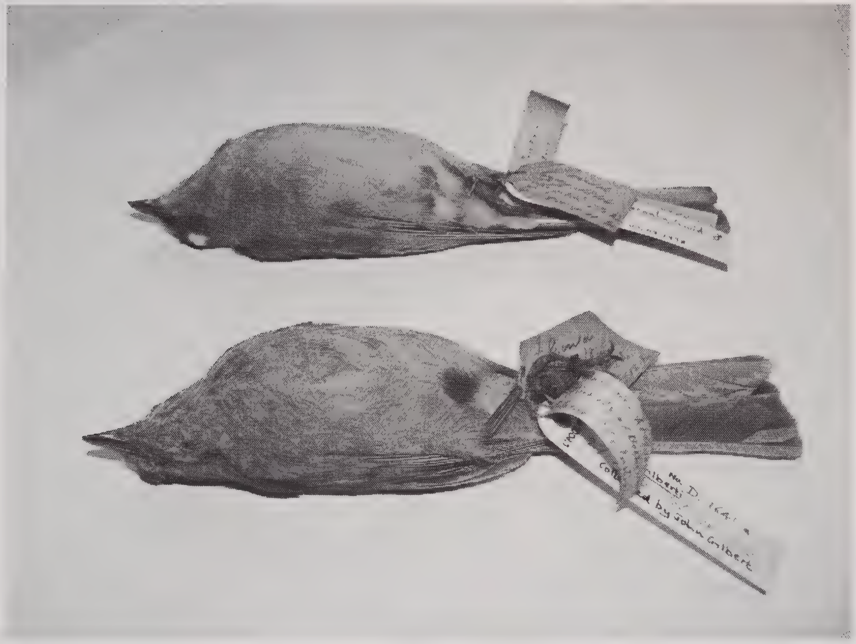

Figure 10. Two of Gilbert's original specimens of Gilbert's Whistler *Pacycephala inornata gilbertii*, now in National Museums Liverpool. The adult male (LIVM D.1641, a paralectotype) was collected near York, east of Perth, in August 1843. Gilbert also collected an immmature male Gilbert's Whistler two months later when he was in the Botherling area (LIVM D.1641a, foreground).

Gilbert had returned south to the settlement of York by 19 August 1843, when he collected his first specimen of a sturdy songbird which Gould later named after him—the Gilbert's Whistler (*Pachycephala gilbertii*, now *Pachycephala inornata gilbertii*)[122] (Figure 10).

During his travels in the York area Gilbert had made some good friends—he often stayed at "Woodside," the home of Robert Brockman, a 20,000 acre (8094 ha) holding about 11 miles (17.6 km) north of York. In about 1889 A. J. Campbell interviewed Mrs. Brockman, then an old lady, who gave us the best and most detailed description of John Gilbert that exists.[123]

She said that the Brockman family had liked him so much, they had asked him to make their house his headquarters and he had stayed with them often. He would go out after birds at daybreak, not returning till late afternoon—when he would sit down to skin and fill out the birds before dark. Gilbert would sing for them in the evening; apparently he was a fine tenor with a good selection of songs. His favourite was a hymn:

> "No more shall the children of Judah sing
> The lay of a happier tune
> Or strike the harp with the golden string
> 'Neath the sun of an eastern clime."

Gilbert was very much an enthusiast at his work, never sparing himself and often tired at the end of a long day's tramp after some particular bird, but "as pleased as a child if he succeeded in shooting it."

Mrs. Brockman went on to mention that Gilbert had a dread of attack from Aborigines, and that he had told them he was a widower and "spoke in very loving terms of a little daughter he had left in England." She continued:

> "I wish I could recollect more about him; I shall only add once more that we all liked him much and thought highly of him. I remember his face now perfectly, as he used to look when he came in and threw off his heavy pack. He would say: 'Now for a sup of your nice tea and I shall be all right.' I think he was, altogether, nearly two months in our neighbourhood; then he travelled on towards Toodyay."

Campbell himself continued from Mrs. Brockman's account: "Gilbert has been further described as having been a pleasing and bright companion. In stature he was somewhat short and spare, but strong and active. His complexion was rather dark than fair." Unfortunately Campbell gave no reference for this information, although possibly these were additonal remarks by Mrs. Brockman.

Gilbert continued to collect in the "vicinity of York" until about 10 September 1843, when he collected an Elegant Parrot there.[124] Labels on various Gilbert specimens tell us that he then moved north again to Toodyay, Botherling (about 40 miles (64 km) north of Northam), and the Wongan Hills.[125]

On 15 December Gilbert wrote to Gould from Perth,[126] reporting that he had loaded four packages of specimens on the *Napoleon*, bound for England. These included bird skins (200 specimens), mammals (interestingly a higher number of these: 232 specimens of 42 species), eggs (representing 70 species), and plants, as well as animals in spirit for dissection. In total, from this second trip to Western Australia, Gilbert had sent Gould 318 mammals, 432 birds, and eggs of 77 species of birds. He had also enclosed lists of the birds and mammals known to inhabit Western Australia, with their Aboriginal names, and thought that he had probably added 22 new mammals and 36 birds to Gould's collection. Gilbert considered that although only a few of these birds would turn out to be new to science, many of the mammals would be—in fact Gould described at least 10 new mammals and 12 new birds which are valid taxa from Gilbert's second Western Australian collection, although many of the birds are now considered to be subspecies.

EASTERN AUSTRALIA 1844-1845

On 20 December 1843, Gilbert left Western Australia on the *Timbo* for Launceston, via Adelaide. After arriving in Tasmania on 16 January 1844, he transhipped to the *Union*, bound for Sydney, arriving on 30 January.[127] While he was in Sydney, Gilbert stayed with the natural history collector Frederick Strange, who as a side-line ran a boarding house with his wife in Princes Street. At the end of February the pair were planning to go "to Brooken [sic] Bay after some Wallarroo" [i.e., kangaroo-hunting].[128] The 13th Earl of Derby's naturalist John MacGillivray[129] was there at the same time—before he left again on H.M.S. *Fly* in March 1844—and it seems that Gilbert never made his collecting trip with Strange, as he left Sydney for good at about the same time as MacGillivray.[130] Gilbert was still in Sydney on 4 March, when he went with George Bennett (Curator of the Australian Museum) and Joseph Jukes (the official naturalist on the *Fly*) to see some giant bones from New Zealand (Jukes 1871), but he had decided to start working his way north along the stock routes through New South Wales, up to the Darling Downs of present day Queensland. Gilbert knew that that region was only just being settled, and that all the land to the north was unexplored. What new species might he find there?

Gilbert began a diary of his journey on 18 March 1844, using a little black leather-bound notebook in which he had previously made pencil notes on mammals, birds, and fish.[131] Gilbert had sailed from Sydney to Newcastle on the coastal steamer *Rose*, which then travelled up the Hunter River as far as Morpeth, where Gilbert expected a horse to have been left for him. Finding no such horse, he took the mail coach north, along the appalling "road" which ran alongside the Hunter:

> ". . . the major portion of the road is in very deep ruts, and the shaking I received in a very crazy vehicle, would perhaps have had a beneficial effect had I been of a nervous temperament . . ."

The mail coach only went as far as Scone, near the Coxen's station at Yarrundi. Stephen and Charles Coxen[132] were brothers of John Gould's wife Elizabeth, and John Gould had spent much time collecting in the Yarrundi area during his visit of 1839-1840. The brothers could not have been there at the time Gilbert visited, as they were both heading for Sydney in order to sign insolvency papers,[133] leaving their nephew Henry W. Coxen in charge, apparently not only of the station but also of a huge mob of animals being moved up to the Darling Downs. Gilbert must have known about this drive, perhaps because it may have started from Sydney,[134] and had therefore planned to join the party en route as they herded the stock north. Gilbert actually spent only one night at Yarrundi; he was on the road north again the next morning (21 March 1844). Presumably he was anxious to catch up with the drovers, although he only travelled seven miles (11.2 km) that day, to Cressfield.

The next day he crossed the Liverpool Range to Loders, a property near the present town of Quirindi. On 23 March, Gilbert passed Breeza, a station belonging to Andrew Lang on the Mooki (Conadilly) River. This must have marked the first site of co-incidence between Gilbert and a man with whom he was destined to become intricately bound, the German explorer Friedrich Wilhelm Ludwig Leichhardt. Ludwig Leichhardt (as he was known) had stopped at Breeza on 5 April 1843, during his journey through New South Wales. Gilbert must have been following Leichhardt's path almost exactly a year later and thus heard much about the explorer from the stockmen and farmers en route.

Gilbert moved on past Long Point, on the Mooki River, and over the plains to Gunnedah Station, where he stayed on the night of 23 March. Much of the landscape was affected by the "effect of heat and grasshoppers."[135] Not far north of Gunnedah he crossed the Namoi River, and late in the day arrived at William Wentworth's cattle station, Burburgate. On 25 March, Gilbert travelled 30 miles (48 km) north along the Namoi, horrified by the vast numbers of locusts, which were dropping into the grass in such numbers that they looked like a "fall of snow." Some local people told him that the insects had been passing for three days without a break, and had stripped the land completely of grass. They constantly flew into his face, striking painfully with their sharp little claws, and were now busily laying eggs in little holes; the whole ground was honeycombed.

Thunder, lightning and rain occurred overnight, and on the next morning not a locust was to be seen. As a result, Gilbert made 30 miles (48 km) along the Namoi to "Gundemaine" (eight miles [12.8 km] northwest of the present town of Narrabi), where he finally caught up with the droving party. Gilbert was able to stop and make a list of all the birds he had seen on the first part of his journey, and to do some collecting. He obtained the nest and eggs of Plum-headed Finch (*Neochmia modesta*) and Diamond Dove (*Geopelia cuneata*), and also mentioned that he had collected both nest and eggs of the "Peristeri," the Flock Bronzewing (*Phaps histrionica*), an interesting observation given the pigeon's present distribution.

For the next few days the droving party saw many Flock Bronzewings, which laid their eggs on the bare ground, and indeed dubbed the watercourse they followed on 4 April "Peristera Creek." Gilbert collected a Letter-winged Kite (*Elanus scriptus*), the "Til-yeer-gar-bul" of the Aborigines, at "Goolathra" ("Galathera," another of William Wentworth's properties) on 4 April.[136] They had left the Namoi and were reaching the area that had been the limit of European settlement just five years before, when John Gould collected there.

At Millie Creek (then Waterloo Creek[137]) Gilbert saw woodswallows overhead,[138] and as they continued northwards over the plains he shot an Australian Bustard (*Ardeotis australis*). The Flock Bronzewings were still abundant, and Gilbert also saw Peregrine Falcons (*Falco peregrinus*) and kites in great numbers, devouring even greater numbers of locusts (which had re-appeared). On 7 April they arrived at the "Big River," the Gwydir, and travelled through much more park-like, open country. On the 8th, Gilbert collected the first specimens of a new freshwater fish, "Pob-be of the Natives," later described by Albert Gunther as *Therapon unicolor* (now *Leipotherapon unicolor,* the Spangled Perch).[139]

The next day they came across the biggest encampment of Aborigines that Gilbert had ever seen, engaged in a "noisy corrobori, or what might be termed vociferous screaming," which kept the drovers awake all night. The morning afterwards Gilbert watched the

Aborigines grinding grass seed into a paste, and was interested in which species of plants they ate. After a day's rest, Gilbert's party moved off along the Gwydir River, now travelling south-easterly; on 12 April, Gilbert sourly recorded the poor hospitality at George Gally's station Gingeroi, where the party "went to bed on a midshipman's supper."[140]

On 14 April they left the "Big River" and travelled up Myall Creek, following what Gilbert called "the main road leading to the [Darling] Downs." They stopped at William Waterford's station "Bannockburn," which was surrounded by extensive open plains, with rising hills beyond and a creek with abundant water. On the 18th they reached Bukkulla on the MacIntyre River, owned by George Wyndham. They continued along Frazer's Creek to Gregory Blaxland's station, and then on to Bonshaw, which belonged to the Reverend Irving Heatherington, on the Dumaresq River (which Gilbert called the Severn). The Dumaresq now forms part of the modern border between New South Wales and Queensland.

Twelve miles (19.2 km) north down Gilbert's "Severn" brought them to William Cox's Station at Gunyan, which is now just south of the modern town of Texas. Here they stopped for about six days,[141] allowing Gilbert to collect specimens, including at least two of a "Small Antechinus"; he recorded the Aboriginal name as "Ne-moo-ga." These must have been Common Dunnarts (*Sminthopsis murina*), specimens which Gould later wrote about in his *The Mammals of Australia.*[142] Gilbert also collected a "*Circus*" at Cox's Station on 23rd April[143] and several other specimens on his "Severn" River.[144] These included a "Moo-ling-ga Spotted-throated Finch," almost certainly a Star Finch (*Neochmia ruficauda*), a bird which is now extremely rare in eastern Australia. He also killed a "Ngoo-re moo-ge-ra … Amadina Lathamii?" (Diamond Firetail *Stagonopleura guttata*) on 24 April, and saw a pair of the "Banded Red-knee" (Red-kneed Dotterel *Erythrogonys cinctus*) and some White-necked Herons (*Ardea pacifica*).

Gilbert wrote at length during this period about the fighting between Aborigines and Europeans in "New England," and how extensive and indiscriminate the shooting of local Aborigines (including women and children) had become. The Aborigines were beginning to retaliate and it had become "cruel warfare." Indeed, a number of stations on the Moonie River were abandoned during this time because of attacks; more personal to Gilbert must have been the knowledge that

Charles Coxen had been assaulted on the Darling Downs in 1843 (Anonymous 1843, Jervis 1962, French 1989).

On 29 April, the drovers took to the path north again, the party by now consisting of cattle, sheep, and a cart, on which (due to the wet and muddy conditions) a wheel almost immediately broke. Through the first days of May they struggled on "constantly breaking our rotten set of Harness" and sinking up to their knees in the mire, passing John McDougall's station, "Collebelaa," on the site of the present town of Texas. On 9 May the party had reached Mosquito Creek, where Gilbert collected more of his new species of "Spangled Perch." They then followed Canal Creek north to "Pitt & Bonaparts," on the Darling Downs, and then up the Condamine River.

Gilbert's pencil notes are almost unreadable in this part of his diary, but luckily we *can* just read the entry for 17 May, for on that day Gilbert wrote "To Gores. New Parrot." "Gores" must refer to St. George and Ralph Gore's station, "Yandilla," on the Condamine River and the "New Parrot" was the beautiful, iconic and sorely missed Paradise Parrot (*Psephotus pulcherrimus*), a species not seen since the late 1920s. This new species was described by John Gould in 1845 from Gilbert's specimens; Gould's type description was copied almost word-for-word from a detailed description of the parrot—"the most beautiful of the whole tribe"—included in a letter sent to him by Gilbert.[145] We know that the diary entry Gilbert made on 17 May must refer to his actual discovery of the Paradise Parrot, as this is the same date that he wrote on his field label for a specimen which is now in National Museums Liverpool.[146] Gilbert must have collected this first Paradise Parrot on the Condamine River somewhere between the station where the party had spent the previous night, "Tummaville" (which was owned by Dr. John Rolland and Domville Taylor), and "Yandilla."

Gilbert probably collected six or seven Paradise Parrots on the Downs during the next few months, but only two more specimens have been found that still have Gilbert's original labels attached. One is now in the Museum of Comparative Zoology at Harvard University, but has no type status as the collecting date postdates the letter Gilbert sent Gould on 8 June (which in effect was the type description). The other, like the adult male which Gilbert collected on 17 May 1844, is now in National Museums Liverpool; its collection date also postdates Gilbert's letter. Both these birds are males, but not in full breeding plumage[147](Figure 11).

Frederick Strange, to whom Gilbert entrusted a parcel of specimens (en route to Gould in England), which included examples of his new parrot, reported that Gilbert had written that the bird "beat any thing that he have [had] met with in Australia."[148] The attractiveness of the Paradise Parrot contributed to its downfall, as many trappers saw it as an opportunity for cash, and the population also suffered as a result of recurrent droughts and from competition by grazing stock. Many naturalists have tried to find the Paradise Parrot since the last authenticated sighting in 1927, and there have been almost as many false reports as there have been of a still-living Elvis Presley, but this beautiful parrot, like so many of the Australian mammals which Gilbert discovered, is sadly almost certainly extinct.

On 19 May, Gilbert and the droving party reached "Cecil Plains," the property occupied by Henry Stuart Russell, his brother Sydenham, and Gerald Brooks. Was it here that Gilbert first heard that Ludwig Leichhardt was thinking of forming an expedition to cross Australia? Leichhardt had certainly visited "Cecil Plains" in April 1844, just six weeks previously; indeed, he had tried to persuade the Russell brothers to sign up for his expedition. On the 20th the drovers passed "Old Station" and on the next day finally reached "Jondaryan," the Coxens's property on the Darling Downs. Charles Coxen and John Gilbert are known to have coincided there, so Coxen had either caught up with the droving party after his visit to Sydney, or had met Gilbert later on his return to "Jondaryan."[149]

Little is known about Gilbert's activities between his arrival at Jondaryan in the middle of May 1844, and his departure from "Westbrook," John Campbell's station, on 18 September. We know that he visited J. C. Pearce's station at Helidon, east of the present site of Toowoomba, as his pencilled notes include a comment "Wallaby killed at Pearces about the size of manicatus."[150] Gilbert wrote to George Bennett in Sydney on 10 September, saying that he had "been able to do but little, the weather has been so impropitious the whole time, as to prevent me moving about the country."[151] Nevertheless, as well as the Paradise Parrot, Gilbert had discovered several new small mammals on the Darling Downs—the Stripe-faced Dunnart (*Sminthopsis macroura*) and three rodents.[152] The Darling Downs Hopping-mouse (*Notomys mordax*), which is only known from a single skull, was also probably discovered by Gilbert during his time on the Downs.[153]

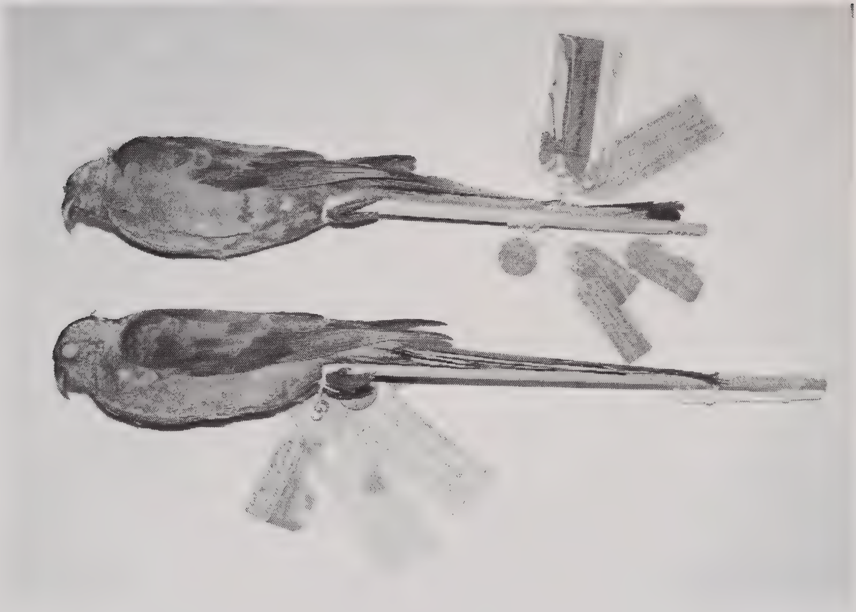

Figure 11. Two of Gilbert's specimens of the Paradise Parrot *Psephotus pulcherrimus*, which he discovered on the Darling Downs in 1844. These two are now in National Museums Liverpool. The upper bird (LIVM D.789a), obtained by Gilbert from the Condamine River in May 1844, was the first ever collected.

Gilbert also sent back collections of freshwater shells and fish to Gould, and seeds to George Bennett, but perhaps he was unduly frustrated by the paucity of his collections from eastern Australia, compared to those he had made in Western Australia and Port Essington. Any possibility of joining a party venturing into unknown territory would have seemed irresistible. Gilbert had always been concerned about Aboriginal attack, but the tales he had been told on his way up through New South Wales may have really worried him, and deterred him from moving any further north or west on his own.

In the early 1840s a select committee under Sir Thomas Mitchell had been set up by the New South Wales Legislative Council to enquire into the practicability of an overland route to Port Essington. The committee recommended it as a feasible proposition; they hoped it would allow a flow of cheap Asian labour through Port Essington to more settled areas. However, the idea of a government expedition had stalled, and instead been taken up as a private enterprise by a German explorer slightly younger than Gilbert—Ludwig Leichhardt, himself an experienced natural scientist. By the beginning of September 1844 Leichhardt had arrived on the Darling Downs (the proposed starting point of his expedition), after sailing from Sydney to Moreton Bay with five men and supplies, and was busily organising his expedition and drumming up support from the local squatters.

If John Gilbert did indeed meet Ludwig Leichhardt at the Coxen's station "Jondaryan," it must have been late in August 1844. Gilbert would have seen the proposed expedition as an ideal opportunity to collect in previously unexplored parts of Australia, while under the protection of an organised party. In his letter to George Bennett,[154] Gilbert wrote that his membership of the "Port Essington Expedition" "offers a glorious opportunity of unmasking the hidden novelties of tropical Australia … I have little doubt … that as we approach central Australia, forms totally different from any we are acquainted with exist in the unexplored parts of this great island."

Gilbert thought it would also help him determine the geographical ranges of many of the birds, and thus help John Gould complete his great work, *The Birds of Australia*. He begged Leichhardt to be allowed to join the "Port Essington Expedition," and eventually the German agreed.[155]

Much later Leichhardt wrote in his *Journal* (1847:xv-xvi):

> "Of Mr Gilbert I knew nothing; he was in the service of Mr. Gould, the talented Zoologist who has added so much to our knowledge of the Fauna of Australia, and expressed himself so anxious for an opportunity of making important observations as to the limits of the habitat of the Eastern Coast Birds, and also where those of the North Coast commence; as well as of discovering forms new to Science during the progress of the journey, that, from a desire to render all the service in my power to Natural History, I found myself obliged to yield to his solicitations, although for some time I was opposed to his wish."

Relations between Leichhardt and Gilbert were thus strained from the beginning—as confirmation that the two men started off with mutual agendas of competition and distrust is another remark Gilbert made in his letter to Bennett:

> "I must confess … at the same time, when I first heard of the German's intention, I felt a little jealous of a foreigner being the first to make known the hidden treasures of this vast and interesting country, which has been for so many years the particular province of our own countrymen."

Leichhardt also added three other men to his party, making ten in total: Leichhardt; Gilbert; James Calvert, who had been living on his brother's property near Newcastle; John Roper; John Murphy (who was only 16); William Phillips (a prisoner on licence); Aboriginal trackers Harry Brown and Charley Fisher; Darling Downs squatter Pemberton Hodgson (who ran "Eton Vale" with his brother Arthur, and was a cousin of the Russells of Cecil Plains); and Caleb, an African American, as cook. Of these, the only experienced bushmen were Gilbert, Leichhardt and the two Aborigines.

Gilbert busily set about equipping himself for the expedition. He drew money on John Fairfax (John Gould's Agent in Sydney) and Charles Coxen. On 14 September Gilbert was at "Hughes & Isaac" (H. H. Hughes and F. N. Isaac's property on Gowrie Creek) buying a horse (for £14), saddles and shirts; he also purchased a horse at "Stevens" (Stephens, John Campbell's partner at "Westbrook") for £25.[156] Gilbert also packed up a box of specimens, including examples of his new parrot and small mammals, to send back to England via Strange and Bennett in Sydney.[157]

The Leichhardt expedition left "Westbrook" station on the Downs on 18 September 1844. They had 16 head of cattle, 17 horses, 7 pairs of "kangaroo dogs" and various terriers, 1200 lb of flour, 200 lb of sugar, 80 lb of tea, and 20 lb of gelatine; their ammunition amounted to 30 lb of powder and 8 bags of shot. Everyone had at least one change of clothes. They moved slowly past the outlying stations of "Gowrie" and "Jondaryan," trying unsuccessfully to persuade their mainly novice pack-animals from bolting; they lost much of their flour. At "Jimbour,"[158] the home of Thomas Bell and the last residence of all, they re-provisioned.

With these unexpected loads all the horses and cattle had to carry provisions, and when, on 1 October 1844, the First Leichhardt Expedition officially began, all 10 humans were on foot. They strode away from "Jimbour" singing "God save the Queen"; henceforth they would be moving into uncharted territory. Gilbert's journal of the expedition, a daily record written—most thankfully—in ink, was started that day, and is a fascinating record of geographical details, the fauna and flora, and specimens collected. After several days, however, Gilbert must have despaired, as the expedition moved at a snail's pace and various blunders (mainly by Leichhardt) again caused the loss of a great part of the expedition's flour. The daily life of the expedition members—who seemed to spend a vast proportion of the day looking for straying cattle and horses—was not what Gilbert expected, and only on those days when they were stationary could he "go out for a ramble" with his gun.

It is therefore impressive that Gilbert not only collected many specimens of birds (and taught John Murphy how to prepare skins), but that these are properly labelled, and that he somehow also found the time to write so much about the objects of natural history which he came across. Astonishingly, Gilbert collected, and carefully labelled, several birds' eggs during the first few days of the expedition—even more astonishingly, many of these survive.[159] We do not really know if Gilbert collected any mammals on the expedition, as Leichhardt was adamant that only the specimens of birds that had been collected should be attributed to Gilbert, but the Englishman did make some interesting written comments about kangaroos, as well as fish and molluscs. The earliest bird skin found from the expedition is a Leaden Flycatcher (*Myiagra rubecula*), collected on 6 October 1844, and now in the Liverpool collections.[160]

The party moved slowly north, reaching the Condamine River on 7 October, and on the 10th crossed a creek, which became the first geographical feature to be named by the party. Leichhardt called it Charley's Creek after their Aboriginal tracker Charley Fisher; they were near the site of the present town of Chinchilla (where there is now a monument to both Leichhardt and Charley). To the north they could see a thick scrub, which Leichhardt insisted in trying to force his way through. Again they lost huge amounts of provisions as bags were torn from the pack animals[161]—most seriously, Gilbert's gun was broken and his tent lost.

They returned to their campsite of the previous evening, "Kent's Lagoon," where they stayed for about 10 days, sheltering from the rain and retrieving scattered stock and possessions. Tempers were frayed: after an altercation with Gilbert, Charley "threatened to fire a ball" into him, and was exiled from the camp by Leichhardt (the first of many such banishments). The lack of the expedition members' bushcraft was emphasised by Murphy and Caleb, who went out hunting and were lost for three days. They were eventually tracked down by Charley, who found them "returning" to "Jimbour," but in completely the wrong direction.

However, at Kent's Lagoon Gilbert was at last able to pay attention to birds, and indeed on 20 October made a long list of the species he had seen during their enforced stay, which included his "Platycercus (new)," the Paradise Parrot.[162] Gilbert had also collected several specimens, including a Yellow-faced Honeyeater (*Lichenostomus chrysops*) and an "Acanthiza," which he thought was "either nana or reguloides."[163] The expedition moved off again on 21 October, trying to cope with their fresh, bucking bullocks, some of which managed to shed their loads. They were travelling through flat but thickly timbered country, skirting the by now notorious scrub. Gilbert saw the Channel-billed Cuckoo (*Scythrops novaehollandiae*) for the first time, its "extraordinary harsh loud croaking kind of sound" reminded him of the Brolga (*Grus rubicunda*).

On Leichhardt's 31st birthday, 23 October, Gilbert killed a "Eurostopodus albogularis" (White-throated Nightjar *Eurostopodus mystacalis*) and collected a "new Mus" and "a Ptilotis which is either fusca or a near ally."[164] The expedition members between them also collected a Brolga and three bronze-winged pigeons (*Phaps* sp.). All were obtained near their campsite, in the angle between two new watercourses they had discovered, which Leichhardt named Acacia and Dogwood creeks. As a treat to mark his birthday, Leichhardt ordered that most of the game they had shot be prepared as a "sea-pie."

The next day Gilbert dissected the Brolga, admired the convolutions of the trachea and the hollow keel, and inspected the great number of pebbles in the stomach. They ate the remains for breakfast. Later that day Gilbert saw a Spiny-cheeked Honeyeater (*Acanthagenys rufogularis*), the first he had seen since the Darling Downs. They moved across a small open plain, giving much relief after being "so long buried in the depths of a dense forest," but were soon back in the scrub, where they came across bottle trees over 15 foot (4.6 m) in circumference. Gilbert killed a *Zosterops*, which he thought was a Silvereye (*Zosterops lateralis*). On 28 October they decided to stop and kill one of their steers, and experiment with cutting the flesh into strips and drying it—thus their name "Dried Beef Creek," now the much less interestingly named “Back Creek”—which took the next few days. While they were camped, several Aborigines approached, indicating that they should go back the way they had come. The expedition members became worried about their scattered stock, for which they spent the next few days searching.

While the expedition was stationary, Gilbert spent some time out looking for birds, and found a nest of the Eastern Yellow Robin (*Eopsaltria australis*), containing three eggs, placed at least 30 feet (9.1 m) high on a horizontal branch of a Rosewood tree (*Dysoxylum fraseranum*). He also discovered the nest of a Squatter Pigeon (*Geophaps scripta*), the two eggs lying in a hollow in the ground, with a few dry leaves as flooring. Gilbert shot a Speckled Warbler (*Chthonicola sagittata*) and, more importantly, watched several individuals of the “new green Parrot” and recorded its call:

> “ . . it[s] pretty note at once distinguishing it from all the other parrots, it may be described as Tits-weet with rather a plaintive modulation, and I have never remarked it uttering any harsh or disagreeable cry as is common to most of the tribe.”

This is one of the few descriptions we have of the voice of the Paradise Parrot.

It was becoming obvious that the supplies the expedition had would not sustain them all, and equally obvious that some of the members were not up to facing any more serious tribulations. Leichhardt decided that two men should return, and although it was first suggested that these should be the last two who had joined the expedition (Gilbert and Caleb), it was actually Pemberton Hodgson and Caleb who agreed to return. They had both had enough of danger and deprivation. William Phillips recorded in his diary that:

> “two of our party (Hodgson and Caleb) took their departures from us on their return back, being heartily tired of the short allowance of Food . . . and thoroughly frightened at the hardships and dangers they now saw must be our constant Attendants throughout the Expedition.”[165]

Gilbert added that: “Mr H & the Dr [Leichhardt] could not very well agree both being possessed of odd tempers.” Gilbert suggested that John Murphy should return with them, as he was so young, but Leichhardt thought he could “stand the fatigue.”

Hodgson and Caleb left the next morning, presumably carrying all the natural history specimens that had been collected up to that point, as well as letters and messages. The pair took just two days to return to "Jimbour" (the expedition had taken five weeks to travel the same distance).

The eight remaining expedition members moved off in the opposite direction, and soon came across "the most picturesque country we have yet travelled over." It was luxuriantly covered with grass, with little conical hills dotted here and there. About a quarter of a mile (0.4 km) from their camp on 4 November was one of these curious sandstone hills, which they climbed to enjoy the sweeping view.[166] On their journey over the plain the next day, they came across an Aboriginal tomb, which Leichhardt made note of; it consisted of a simple conical heap of sand raised over the body, which was in a squatting position. Gilbert collected a clutch of eggs of the Squatter Pigeon on 6 November[167] and shot a number of ducks near where they camped by a river,[168] within a semicircle formed by six gum trees.

The next day Gilbert left the droving party to their own devices, as they moved across the flats, and rode over the gently undulating hills to get a better view of the valley. On the 8th he collected a "*Ptilotis*," which he thought different from "*P. penicillata*" (*Lichenostomus penicillatus*, the White-plumed Honeyeater). He described it as having "the face much more yellow and the wings brighter," which would indeed fit the more westerly race of the White-plumed Honeyeater, *Lichenostomus penicillatus leilavalensis* (North, 1899), but Gilbert also said it was "a larger bird," which would describe the nominate race of the White-plumed Honeyeater (*Lichenostomus p. penicillatus*), the subspecies that today inhabits this area of south-eastern Queensland. Unfortunately, we may never know, as this specimen has not been found.

The expedition moved from Roche Creek onto Juandah Creek, missing the junction because they took a short cut. Juandah Creek was much complicated by anabranches—as Charley remarked: "I never saw such a rum river, in my life."[169] Gilbert found the nest and eggs of "*Estrelda ruficauda*" (the Star Finch), built of the soft tops of grass and lined with a few feathers. It had been built in the thick sedgy vegetation growing on the banks of Juandah Creek and almost overhanging the water. Gilbert's discovery, along with his sighting of a Star Finch much further south on the Dumaresq River in April 1844, gives us a rather striking indication of the former range of this little grass finch. This has

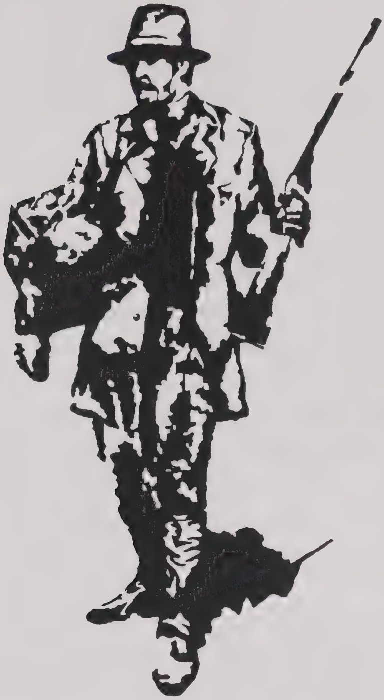

Figure 12. Reconstructed image of John Gilbert by Chris Clayton of National Museums Liverpool, put together from the few scraps of physical description that exist. The portrait was commisioned in 2004 for the monument at Gilbert's Lookout, a bluff overlooking the Dawson Valley at Taroom, central Queensland. © Chris Clayton.

enormously contracted, due in part to habitat disturbance and also to trapping for the cage-bird trade.[170]

On 12 November the explorers came upon the river that is now officially named the Dawson, and Leichhardt and Gilbert rode up a nearby hill to scout. Today, on a bluff on the outskirts of the town of Taroom, is a monument to John Gilbert (Figure 12) and the expedition, flanked by two text panels,[171] one of which reads:

> " … one of the most beautifully picturesque & extensive scenes met our anxious gaze; the immediate vicinity of the hill was more like Park scenery, clear undulating grassy hills with here & there small clumps of Brigalo, while the sides of many of the hills were

> dotted with single scrubs as if planted out by hand, beyond this to the Westward and round as far as we could see to the E.S.E. was a carpet of evergreens for 6 or 7 miles, and then the high ranges rising up and forming a beautiful back ground to the most pleasing natural picture we have seen."

Leichhardt and Gilbert returned downhill and examined the broad bed of the Dawson, which was a maze of connecting lagoons and water courses. They followed the river for the next two days until it turned east, and then struck off north-west until they came across another watercourse, festooned with palms, which was duly named Palm Tree Creek. Nearby were some large lagoons, which Leichhardt called after John Roper. Gilbert's turn came next, as his name was affixed to a range of hills they were approaching, which bound Palm Tree Creek to the north. However, they turned west onto another river they called after the Quaker philanthropist Joseph "Humanity" Robinson, which led them towards a spectacular rocky area now known as Robinson Gorge (now part of Expedition National Park, named in honour of the Leichhardt Expedition).

On 18 November Gilbert was pleased to see Crimson Finches (*Neochmia phaeton*), a species he had found at Port Essington in 1840 and had then thought new. This record is much to the south of the present range of this little finch, which in modern times only inhabits the north coast and an area around Mackay on the Queensland coast.[172] Gilbert also collected another nest of the Star Finch, built in long grass at the edge of a pool. The next day they arrived at a large swamp and lake just south of a range of hills, both of which were named after John Murphy. The shallow lake was covered with birds—waders, ducks and ibis.

Over the next few days the expedition came across a series of rocky gorges, rising up to a tableland, which became more and more difficult for the bullocks and horses to get through. Gilbert collected a specimen of another finch, the Plum-headed Finch,[173] but could not pay much attention to ornithology due to the bad behaviour of the pack animals, which collectively staged a protest against being made to stumble up and down rocky slopes. He did find a nest of the Black-throated Finch (*Poephila cincta*), which contained four eggs. The nest was small and domed, with a lengthened entrance, and was made of dried grass; it had been built in the fork of a *Jacksonia*. Gilbert shot the parent bird from the nest.

On 25 November, when they were camped on what was probably Harden Creek, he again recorded his "New" parrot, *Psephotus pulcherrimus*,[174] as well as "*Platycercus paliceps*" (the pale-headed form of the Eastern Rosella, *Platycercus eximius pallliceps*); he said they were both common. They had camped that night at a rocky water hole, to which many pigeons came when dusk fell. Presumably the parrots which Gilbert listed had come there to drink as well.

Eventually they came to the end of the tableland, and, pushing their pack animals down the steep, loose-screed hill at the north-west extremity, arrived in a rather beautiful valley. Another mountain range rose up in front of them, a jumble of peaks, cupolas and precipitous walls of rocks, which Leichhardt named Expedition Range. On 28 November the party came across a stupendous ravine (Robinson Gorge) which they tried to skirt round, spending several days scouting for a possible route. On the 30th, when they were camped just south-east of Expedition Range, waiting for the scouts to report back, Gilbert got the chance to go out with his gun, and it was on that day that he came across the first undescribed bird of the expedition:

> "In a stroll with my gun, I saw nothing but the most common birds, excepting a pair of Sericornis, which I think may be a new species."

These were indeed new—being individuals of the northern subspecies of the White-browed Scrubwren (*Sericornis frontalis*), a form described by John Gould as *Sericornis laevigaster* in 1847 and often known as the Buff-breasted Scrub-wren. Two birds from John Gould's primary Australian Collection, in the Academy of Natural Sciences in Philadelphia, are probably the pair that Gilbert collected on 30 November 1844.[175] They are almost certainly the specimens on which Gould based his original description.

The next day Gilbert saw a pair of "*Cinclosoma*" he also thought were new, but they eluded him by dodging into a deep ravine. According to Chisholm (1945:190) these might have been Chestnut-breasted Quail-thrush (*Cinclosoma castaneothorax*), a species which was not scientifically described until 1848,[176] but Ian McAllan (pers. comm.) thinks they were probably Spotted Quail-thrush (*Cinclosoma punctatum*).

On 2 December Leichhardt and Gilbert scouted along a system of gullies which wound between broken and fissured sandstone escarpments of great magnitude and beauty, which reminded Leichhardt of the castles of Germany—hence his "Creek of the Ruined Castles." Gilbert thought the sandstone rocks that were perched on high ridges, some worn into grotesque forms, looked like Druidical stones. Eventually, they found another creek—dubbed "Zamia Creek"—down which they could get the pack animals,[177] and returned to tell the others. Meanwhile, some of the other expedition members had found a rock-wallaby haunt, and they all devoted the whole of the next day to hunting them, with limited success.[178]

The expedition, moving north over difficult ground, joined Zamia Creek. The campsite of 4 December was called "Wonga Wonga Camp" after the Wonga Pigeons (*Leucosarcia melanoleuca*) Gilbert saw there; unusually he had time to list the bird species he had seen during an evening ramble.[179] He collected specimens of Fuscous Honeyeater (*Lichenostomus fuscus*) and Yellow-faced Honeyeater. The next day, as they progressed slowly down Zamia Creek, Gilbert again made sightings of the Paradise Parrot and the pale-headed form of the Eastern Rosella.

On 6 December, they had to stay put while straying animals were retrieved, and Gilbert was able to collect several specimens of birds: Yellow-tufted Honeyeater (*Lichenostomus melanops*), Spotted Bowerbird (*Chlamydera maculata*), Turquoise Parrot (*Neophema pulchella*), Plum-headed Finch, Rufous Songlark (*Cincloramphus mathewsi*) and Crested Bellbird (*Oreoica gutturalis*). These are interesting records: the Turquoise Parrot, for instance, was further north than its presently known range, but unfortunately none of the birds Gilbert collected on 6 December has been located in museum collections. They moved on, trying to pick up the pace as they were worried about possible attack by the local Aborigines. At the next camp, just south of a conical hill they named "Mount Aldis," Gilbert investigated the nest of a Sacred Kingfisher (*Todiramphus sanctus*), which had been built in a cliff of sandy soil. He thought this interesting, as previously he had only known the species to nest in trees or deserted termites' nests. He cut away a foot (30.4 cm) of soil before he found the nesting chamber, six inches (15.2 cm) in diameter; there were four young birds and an addled egg.

In the afternoon 9 December, when they had reached a fine pool of clear water surrounded by palms and *Erythrina* trees, Leichhardt called a halt, as he wanted to scout a passage over Expedition Range, which lay directly ahead. They stayed at "Erythrina Camp" for four days, allowing Gilbert to make a small collection of birds, as well as a long list of the species he saw.[180] Again, he listed the Paradise Parrot, a surprising record given that the area is now heavily forested, and must have had considerable tree cover in Gilbert's time.

On 12 December Gilbert, Leichhardt, and Brown found a spur which led them to the top of Expedition Range, from which they had the most magnificent view to the north and west, where even higher ranges towered in the distance. The next day, Friday the 13th, they toiled across the top with all the bullocks and horses; it took them six hours.[181] On the 15th, they came across a substantial riverbed, but it was dry,[182] and the expedition members spent several days trying to find water, in the end moving south to a "fine reedy Lagoon" they named "Browns Lagoon."[183] Here they camped for several days, having killed a bullock and needing time to dry the flesh. Again, Gilbert took advantage of the stop, and collected specimens and listed the birds he saw.[184] Above their tent was a tree in which a pair of White-breasted Woodswallows (*Artamus leucorynchus leucopygialis*) were nesting in an old *Grallina* nest, just below one belonging to a pair of a Leaden Flycatchers, both species "sitting on eggs, and living thus near engaged in their arduous task of incubation in the most perfect harmony." Gilbert, again, recorded that he had seen the Paradise Parrot as well as several other species of parrot; for the first time his list included the Cockatiel (*Nymphicus hollandicus*).

Interestingly, a Black-throated Finch collected at Brown's Lagoon was actually prepared by John Murphy. It seems that Gilbert had somehow found the time during the course of the expedition to teach the teenager how to skin birds and make them up as specimens. The birds in the small collection of the Leichhardt Expedition, now in the Royal Albert Memorial Museum in Exeter, in south-west England, are all Murphy's.[185] A passage in Gilbert's diary (" . . . while Murphy kept me employed most of the day in skinning"[186]) might give a glimpse of the way the two generally shared the duties of bird collector—the boy showing his prowess with his gun, while Gilbert sat patiently skinning the results. A by-product one night was some excellent soup made from Sulphur-crested Cockatoos (*Cacatua galerita*).

After an abortive attempt to leave on the 22nd (when they ran into bad weather), they spent Christmas Day scouting and enjoying a dinner of "suet pudding and stewed cockatoos." The expedition finally left

Brown's Lagoon on Boxing Day, moving northwards up the river—which they later named the Comet after a spectacular show the whole party enjoyed on 28 and 29 December, with "brilliant Meteors flying and shooting in the heavens," just north of where the town of Rolleston is now sited. On the 28th Gilbert again saw the Paradise Parrot.[187] He did not list this species again until 18 June, when they were in the Cape York region, and his sightings there must have been misidentifications. Gilbert's record from 28 December 1844, when they were on the Albinia Downs (just north of present-day Rolleston), may well be the last genuine one he ever made of the Paradise Parrot, and it may well also represent the most northerly record of this lovely bird.

The year ended with a series of quarrels between Leichhardt and Gilbert, mostly about ownership of specimens, but Gilbert was also upset by Leichhardt's refusal to take his advice on anything, particularly bush matters. They moved slowly up the Comet River, passing its junction with modern-day Humbolt Creek on 4 January 1845, and came across two huts which appeared to have been made by a European, and also saw an Aborigine who they thought might have been of mixed race.

Gilbert heard a "clear melodious warble . . . uttered when perched on the topmost dead branches of the highest trees," which he thought was the call of a species of thrush new to him, but he shot at least two of the songsters and realised they were Striped Honeyeaters (*Plectorhyncha lanceolata*), the first he had seen on the trip (rather surprising, given that their modern distribution extends much further south). Gilbert also collected a Variegated Fairy-wren (*Malurus lamberti*), which appeared bigger than those he had seen in Western Australia. "Grebe" or "Diver Camp" on the Comet River on the night of 8 January 1845 marked the first time they had found water in it; Gilbert had shot an Australasian Grebe (*Tachybaptus novaehollandiae*). He noticed vast flocks of Rainbow Bee-eaters (*Merops ornatus*) and thought the sandy nature of the country would suit their nesting habits. There was also an abundance of Squatter Pigeons; they shot at least 25 for dinner one night.

On 12 January they came to the junction of the Comet with a fine river[188] which Leichhardt had discovered the previous day; he called it the Mackenzie after Sir Evan Mackenzie, who had presided over the farewell dinner for the Leichhardt Expedition before they left Sydney. There were many outcrops and loose pieces of coal. After a few days Leichhardt realised the river was flowing to the east, and they decided

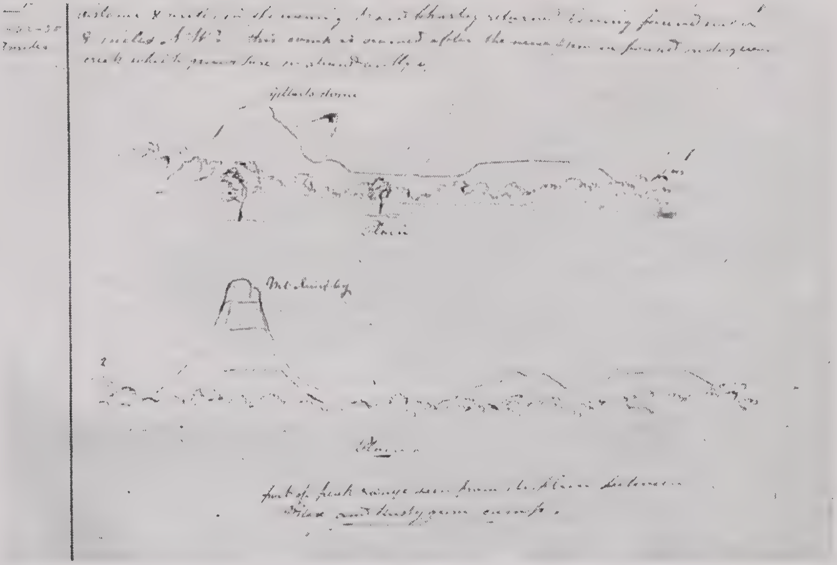

Figure 13. Gilbert's Dome and Mount Murphy, Peak Range, sketched by John Murphy (the youngest member of the Leichhardt Expedition) on 7 February 1845. Murphy's diary is now in the Mitchell Library, State Library of New South Wales, Sydney (ML MSS 2193), as are John Gilbert and William Phillips' diaries and most of Leichhardt's papers from the 1844-1845 expedition. © Mitchell Library, Sydney.

to strike out to the north-west, where they would again face dense scrub and scanty supplies of water. First they killed and dried the flesh of another bullock—with some difficulty, due to damp weather.

Leichhardt, scouting ahead, had come across a fine plain, with a range of hills in the far distance, which in mirage fashion appeared to float on the ground; they looked like a line of tents. He named the hills the Peak Range, and many of the peaks after expedition members: Gilbert's Dome (an immense cupola), Calvert's Peak, Brown and Charley's Peak (which had twin summits) (Figure 13).[189] Once the main party reached the plain, the going was much easier, and birds were more abundant. On 27 January they stopped at "Peak Range Camp," (just south-west of the later-named Mount Demipique) for two days, and Gilbert had time to collect specimens, amongst them a Weebill (*Smicrornis brevirostris*) and a Varied Sittella (*Daphoenositta chrysoptera leucocephala*).[190] He also collected a Black-faced

Woodswallow which almost certainly became one of the types of John Gould's *Artamus hypoleucus* (now *Artamus cinereus hypoleucus*).[191] Meanwhile, Leichhardt and Calvert had ridden off to scout ahead, and became horribly lost, finally returning after 32 hours without food or water. Neither could speak and they were so dehydrated their eyesight had been affected. Gilbert estimated that they drank 2½ gallons of tea, not to mention a considerable quantity of "gelatine soup," before recovering enough to tell their story.

On 29 January everyone moved about 3 miles (4.8 km) back on their tracks to a creek which they knew contained water, to allow Leichhardt and Calvert time to recover. The watercourse[192] was full of crinums, after which they named their camp of the next five days. Here, according to his diary, Gilbert obtained specimens of the White-winged Fairy-wren (*Malurus leucopterus*), a "*Myrafra*"—probably the Singing Bushlark (*Mirafra javanica horsfieldii*)—a "*Caprimulgus*" which he thought the same as the species he had come across at Port Essington (the Large-tailed Nightjar)[193] and "a new species of Porzana."[194] On 31 January Gilbert collected another rail he thought was a Buff-banded Rail (*Gallirallus philippensis*), and the next day a Black-fronted Dotterel (*Elseyornis melanops*).[195]

Passing the first foothills of the Peak Range on 3 February, they camped at "Rocky Basin Camp," where Gilbert killed a raptor that greatly puzzled him.[196] As they passed the range they took pleasure in calling more of the features after supporters of the expedition (Scotts Peak, Mount MacArthur) and admiring the ones that Leichhardt had named after themselves, but during a scouting expedition with Leichhardt both Aborigines disappeared, taking two horses with them, a huge worry to the rest of the party. The pair returned two days later, but it was another indication of the tensions within the expedition.

The expedition came across another, winding, watercourse they called the Hughes, which was dry but supplied with water by many of the little rocky creeks which ran into it. The scouts found a fine lagoon hidden in the scrub, where they camped. After Leichhardt inaccurately insisted that in the outback crows only ate grain and not carrion, they made some rather surprisingly successful experiments with stewed crow (presumably Torresian Crow *Corvus orru*, not Australian Raven *Corvus coronoides*, as the birds were present in considerable numbers). The site became "Crow Camp."

Here Gilbert collected a Brown Honeyeater (*Lichmera indistincta ocularis*) and added two new species to his list of birds seen on the expedition: the Black Honeyeater (*Certhionyx niger*) and a bird he called "*Myzomela erythrocephala"*—which must have been the Scarlet Honeyeater (*Myzomela sanguinolenta*). The latter two honeyeater records are of considerable interest today; this area east of the Harrow Range and north-east of the Peak Range is now far beyond the present range of the Black Honeyeater, and is at about the limit for that of the Scarlet Honeyeater.[197]

Gilbert also killed and eagerly dissected a Painted Snipe (*Rostratula benghalensis australis*), a species that he had never seen in its natural habitat before.[198]

On 15 February the expedition moved up to a new river, which they named the Isaacs,[199] camping at a reedy lagoon under a range of hills. Leichhardt and Gilbert went off scouting northwards the next morning and rode up a nearby peak, which Leichhardt named after "Mr Coxen" (presumably Charles). From this vantage point they could see that the Isaacs valley extended a great distance over flat country, which looked like easy country for travelling. Generally the country seemed dry, and they decided to stay put and slaughter another bullock, hence "Bawley's Last," their camp of 15-20 February. The camp was the venue for a serious disagreement between Charley and Leichhardt, which led to a fist fight, lost teeth and Charley's banishment from the expedition. Brown went with him.

Eventually, on 21 February, the rest of the party moved off again along the Isaacs River, taking a long time to get ready without the help of the two Aborigines. At "Reconciliation Camp" on the 22nd, the Aborigines re-appeared and begged to be forgiven; Leichhardt in the end agreed, but took away Charley's tomahawk. Other critical situations also existed; their little terrier vanished and the one remaining dog was so weak it had to be carried. They also decided to stop putting sugar in their tea and save the little that remained for emergencies.[200]

Gilbert recorded that on the night of 24 February, while at "Crimson-winged Parrot" Camp, they were visited by many such birds (Red-winged Parrots *Aprosmictus erythropterus*), as well as "Bronze-necked Doves" (Bar-shouldered Doves *Geopelia humeralis*), "Blue Mountain Birds" (Rainbow Lorikeets *Trichoglossus haematodus*) and "all the species of Honey-suckers . . . I have from time to time remarked." Gilbert also listed some species which he had seen several times as they travelled along the Isaacs: five species of woodswallow (White-browed Woodswallow *Artamus superciliosus,* Dusky Woodswallow *A. cyanopterus,* Little Woodswallow *A. minor,* White-breasted Woodswallow *A. leucorynchus leucopygialis* and Black-faced Woodswallow *A. cinereus*), Eastern Rosellas (*Platycercus eximius palliceps*) and Turquoise Parrots (the latter record again indicating that this parrot's distribution extended much further north than in modern times). The White-browed Woodswallows were seen in large flocks, and the others were also common.

At the beginning of March, 1845 they were still on the Isaacs, but approaching its source. At "Lumbago Camp" they were stationary for three days while Leichhardt recovered from a form of paralysis. Gilbert went out with his gun and collected specimens of Black-faced Monarch (*Monarcha melanopsis*) and Western Gerygone (*Gerygone fusca*).[201]

On 7 March, with Leichhardt improved enough to mount his horse, the expedition reached a new watercourse they called the Suttor "in honor of a Gentleman of Bathurst to whom the expedition is very much indebted" (he had given them four bullocks). The next day they passed through the wide gap between the northern end of the Denham Ranges and the southern tip of the Leichhardt Ranges. Gilbert spotted what he thought was a Chirruping Wedgebill (*Psophodes cristatus*), which would have represented a record far to the east of its modern range, but unfortunately their guns were so wet from the "constant mizzling rain" he could not shoot it. He saw many finches (Double-barred Finch *Taeniopygia b. bichenovii*, Plum-headed Finch, Black-throated Finch, and Chestnut-breasted Mannikin *Lonchura castaneothorax*) and noticed that Spangled Drongos (*Dicrurus bracteatus*) were becoming common.

On the evening of 8 March they camped early, and Gilbert was able to go out for an ornithological ramble. That night he wrote out a long list of the birds that he had seen at the "Second Camp on Suttors Creek." This list included several important records, such as Black-throated Finch, as well as Squatter Pigeon, Turquoise Parrot, and Yellow-eyed Cuckoo-shrike (*Coracina lineata*). The shrike was Gilbert's first record of this species from the expedition, as was the Blue-winged Kookaburra (*Dacelo novaeguineae*).

Suttor Creek took a southerly turn, so the expedition headed more directly west, and on 12 March came to the watercourse into which it fed, which they named the Suttor River. They decided to follow it, even though it still ran south-west. Gilbert's 33rd birthday on 14 March 1845 seems to have been celebrated only by the name of their campsite ("Gilbert's Birthday Camp"),[202] which today lies less than two miles (3.2 km) east of Eaglefield Station. The camp was at a pool nearly half a mile in length, on which were many ducks, cormorants, and ibis.

The Suttor River west of this point starts to break up into numerous gullies, running mostly parallel but winding greatly. On 19 March they camped on the most southerly gully on the northern end of a large pool of water (now known as Lake Suttor), two miles long (3.2 km) and covered in water birds. They enjoyed roast duck for supper.

On Good Friday (21 March) they celebrated with an extra share of "Fat Cake" and four roast ducks, and allowed themselves sugar in their tea. Their next few campsites on the Suttor River are now buried under Lake Dalrymple reservoir,[203] but Gilbert did not have much to report ornithologically during this period as he was distracted by a nasty boil on his knee, which made both riding and walking difficult. He thought he might have heard a Paradise Riflebird (*Ptiloris paradiseus*), a bird he would not have come across before, but the habitat makes this extremely unlikely. Charley, however, took over food gathering duties and had considerable success with game shooting, as the Suttor in this area was even then nearly a continuous stretch of water; he acquired an Australian Pelican (*Pelecanus conspicillatus*) for the dinner menu.

Under the shadow of "a large Domed Mountain" (which they named Mount McConnell) they stopped for three days to kill and prepare another bullock. On 2 April they reached a large river which Charley had come across while scouting the day before, and settled for the night in the bed of the Suttor at its junction with the new river, which had a proper stream running over a gravel bed—thus their "Camp of the Murmuring Waters." Leichhardt named the new river after a "Mrs Burdekin," another supporter of the expedition.

The Burdekin was difficult to travel along, because rocky hills ran parallel with it, with innumerable deep cuts running down into the river. They could not travel in the bed of the river because there was too much water in it. At one point they had no option but to take to the river, Gilbert (who could not swim) relying uneasily on his horse. On 5 April, he managed to collect a Rufous Whistler (*Pachycephala rufiventris*)[204] and the next day noticed an unusually large bowerbird's structure decorated with shells and seeds, but generally there was no time for natural history. It took all their time and energy to keep the bullocks moving.

On 10 April they passed east of the site of the present town of Charters Towers,[205] camping that night on an anabranch near the junction of the Burdekin with the Fanning River. On the 13th, while passing north of the maze of watercourses and lakes formed by Allingham, Lolworth, and Fletcher creeks, Gilbert saw his first "*Tadorna rajah*" of the expedition (the Radjah Shelduck *Tadorna radjah*, which is sometimes known as the Burdekin Duck). He also recorded Ospreys (*Pandion cristatus*) nesting in a tree; from their behaviour he concluded that they had chicks. Gilbert also collected specimens of the Radjah Shelduck and a White-bellied Sea-Eagle (*Haliaeetus leucogaster*) and made notes on four species of kangaroos they had seen.

On 14 April they struggled along the Burdekin at a point just northeast of the eastern end of the Toomba lava flow known as the "Great Basalt Wall," which kept extruding into their path; Gilbert called it a "horrible rocky ridge." However, in his diary for that night Gilbert wrote that he had "shot a new bird, assimilating to Petroica and Eopsaltria," which "Inhabits the dense jungle like vegetation beneath the shade of the Fig tree; on the banks of the Burdekin."

He succeeded in shooting two specimens, but unfortunately both were so mutilated that he decided to wait till he had obtained other specimens before recording the details of the new species. Over the next few days[206] Gilbert managed to obtain enough material to be sure this was indeed a new robin. From these specimens John Gould named the new species *Petroica superciliosa*; the bird is now known as *Poecilodryas superciliosa*, the White-browed Robin.[207]

National Museums Liverpool hold two almost completely flat specimens of the White-browed Robin, unusually poorly made by Gilbert's high standards, and perhaps these were the two birds that Gilbert nearly blew apart on 14 April (although he has only recorded the month of April 1845 on their labels). The series of White-browed Robins which Gilbert collected on the Burdekin River has left a deeply convoluted trail, mainly caused by Gould's international salesmanship. As well as the two White-browed Robins now in Liverpool, Gilbert's specimens are distributed between museums in Philadelphia, Leiden (in the Netherlands) (Figure 14), and Melbourne. Another was collected on the expedition by John Murphy, and this is now in the Royal Albert Memorial Museum in Exeter, United Kingdom.[208]

Gilbert saw bowers of the *Chlamydera* on 15 April, and thought they were different from those of the Spotted Bowerbird which they had

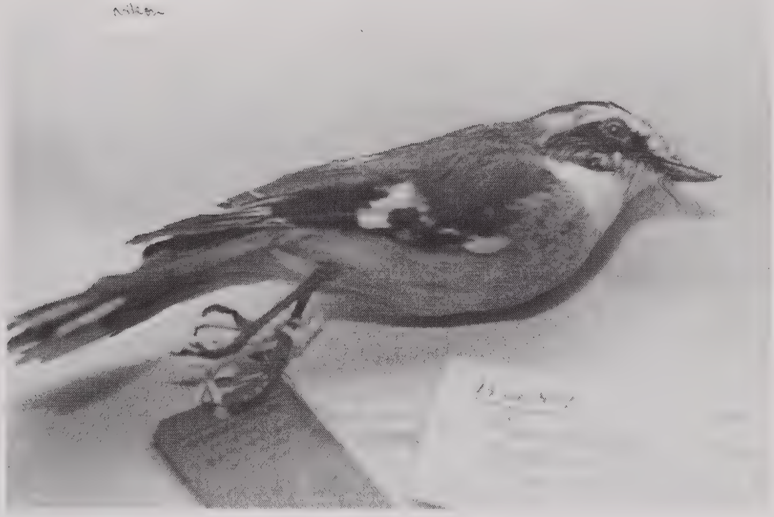

Figure 14. One of Gilbert's type specimens of the White-browed Robin *Poecilodryas superciliosa*, collected on the Burdekin River in April 1845. This is now in *Naturalis*, Leiden, The Netherlands (RMNH Old Catalogue No.1), but other individuals from the same type series are in museums in Liverpool, Exeter (collected by John Murphy), Philadelphia, and Melbourne.

seen on the Isaacs River. He was undoubtedly correct in thinking they had been made by the Great Bowerbird (*Chlamydera nuchalis*), with which he had become familiar at Port Essington. Gilbert also collected more bird specimens: a "*Sittella leucoptera*," which was probably a White-headed form of the Varied Sittella (*Daphoenositta chrysoptera leucocephala*) and a Silvereye. Neither specimen has been found.

Gilbert also collected a "yellow Ptilotis" on 15 April, which he thought was either new or the Yellow Honeyeater (*Lichenostomus flavus*), the species "killed by Mr Bynoe on the North Coast." Benjamin Bynoe, Surgeon on H.M.S. *Beagle*, had indeed collected the type specimen of *Lichenostomus f. flavus*, by inference on the coast of Cape York, but Gilbert's specimen of 15 April must have been a Yellow Honeyeater of the race which occurs in the Burdekin River area, *Lichenostomus flavus addendus* Mathews, which was not formally described until 1912 (from specimens from Inkerman). Indeed, Gilbert's specimens, if they were indeed *Lichenostomus flavus addendus*, predated Mathews' type description by nearly 70 years.[209]

Gilbert's Yellow Honeyeaters are otherwise notable for being the subject of one of the most inventive pieces of ornithological misinterpretation I have ever encountered. In Meyer de Schauensee's 1957 paper *On some avian types, principally Gould's, in the collection at the Academy*, he refers to the two female Yellow Honeyeater specimens then held by the British Museum as having been collected by "R. Burdekin at Port Essington." From this throwaway remark, which should have been phrased "collected at the River Burdekin on the Port Essington Expedition," comes all subsequent mistaken references to the possibility of Yellow Honeyeaters occurring on the north coast of the Northern Territory.[210]

On 16 April the members of the Leichhardt Expedition passed the junction of the Burdekin with the Basalt River, and when camped that night, just past where the Star River joined the Burdekin, Gilbert made a list of all the species of birds he had seen that day that he had previously thought they had left behind them to the south. Of significance were his records of Square-tailed Kite, and "Sericornis"—probably a Buff-breasted Scrub-wren (*Sericornis frontalis laevigaster*), the northern Queensland form of the White-browed Scrubwren, but a *Sericornis* of any species would have been a good record; no birds of this genus were recorded in the Dalrymple Shire Fauna Survey of 1978-1981. Gilbert had also shot another "yellow Ptilotis." He collected more specimens of this honeyeater and his new robin on the 19th, as well as a *Monarcha.*[211] They were well into the mountain ranges of Mount Fullstop and on 20 April, after "a regular mountain march," camped just west of Hells Gates.

On the 21st they followed the Burdekin as it bent south-eastwards, through difficult terrain, but Gilbert still had time to go out with his gun. He collected specimens of "*Ptilotis flavigula*" (possibly the Fuscous Honeyeater, or perhaps Gilbert meant ***Manorina** flavigula*, the Yellow-throated Miner*)* and Grey Fantail (*Rhipidura fuliginosa*), and also remarked on the presence of Black-fronted Dotterel, Chestnut-breasted Mannikin, and Tawny Grassbird (*Megalurus timoriensis*). In modern times, this point on the Burdekin (where it bends to the south) is the distributional limit of both Grey Fantail and Tawny Grassbird.

The Leichhardt Expedtion passed the junction of the Clarke River and the Burdekin on 22 April, enjoying the more open country. The next day they passed the lakes at what is now called Christmas Creek. Aborigines had been burning grass, and there were several flocks of a species of pigeon feeding in the burnt areas. At first Gilbert could not make out what they were, and thought they were new, so he went back with Charley in the evening. He was "greatly disappointed" to find they were merely Flock Bronzewings, although these were actually good records for this pigeon species, which today only occurs further west. Gilbert also saw immense flocks of Black-faced Woodswallow (*Artamus cinereus*) "uttering the impatient cry . . . common with regular migratory birds, when collecting just previous to taking their long flight." Mixed in with these birds were a few White-browed and Little woodswallows.

On 25 April they stopped for four days to kill another steer, but unusually Gilbert seems to have made no ornithological observations or collections; he may have been too busy drying meat and mending equipment. The Burdekin had become much narrower and more winding, and by 30 April they could no longer follow the banks but had to take to the stony ridges. Nevertheless, Gilbert separately collected two specimens of Red-capped Robin, and noted that he had seen Eastern Rosellas (*Platycercus eximius palliceps*), Red-tailed Black-Cockatoos (*Calyptorhynchus banksii*), Great Bowerbird, and currawongs (the Pied Currawong *Strepera graculina*). Gilbert also recorded three species of grass finch (Black-throated Finch, Double-barred Finch, and Crimson Finch, this last species beyond the boundary of its modern range) and was surprised to also see a bird he thought was a Noisy Miner (*Manorina melanocephala*), which he had not recorded for a long time.

On 1 May they were relieved to be able to travel in more-or-less a straight line over grassy flats, directly under Ironstone Mountain. Gilbert collected a female "*Pachycephala*" with a brownish tinge on the rump[212] and a Red-backed Kingfisher (*Todiramphus pyrrhopygia*).[213] While he was skinning them "Murphy went out with my Gun, and was fortunate enough to kill a new Finch, most probably a Poephila and certainly one of the most beautiful additions to the Australian Fringillidae which has been made for several years past. The specimen is a female."[214]

Interestingly, someone—possibly Alec Chisholm—has scrawled a pencil arrow and the word "*Gouldae*" over the top of this passage in Gilbert's diary. If Murphy's bird had indeed been a Gouldian Finch, then this would be one of the most interesting distributional records stemming from the Port Essington Expedition material—on 1 May the expedition was well to the south of its present range. In Gould's *The Birds of Australia* (1840-1848, vol.3, text to plate 89, under the entry for the red-headed form of Gouldian Finch, then known as *Poephila mirabilis*) he mentioned that Gilbert had obtained a female Gouldian Finch on the Leichhardt Expedition. Could the Gouldian Finch that Gould mentioned be the same as the female finch John Murphy collected for Gilbert on 1 May? Where is this specimen now? Is it a female Gouldian Finch now in Philadelphia that is labelled "interior of Australia" (ANSP 14634)? Perhaps only time, and chemical analysis, will tell.

From this point northwards the Burdekin became a more meandering watercourse, complicated by balsalt ridges, lava flows, swamps and tributaries. They camped on the night of 3 May on an anabranch of the Burdekin ("Reedy Brook") near numerous fine ponds that were covered "with the beautiful blue Lotus in fine perfection" and over which Comb-crested Jacanas (*Irediparra gallinacea*) wandered. On the 4th the expedition in error started making its way up a creek which ran to the east, they named it "Expedition Creek" and camped there for two nights while Leichhardt, Roper, Charley, and Brown scouted for the true route of the Burdekin.

"Reedy Brook" camp, where Gilbert had been left in charge, was visited by a group of about 18 Aborigines. They startled Gilbert and Murphy while the Englishmen were searching for zoological specimens in the lagoons, appearing suddenly and armed with spears. The visitors then hung about outside the expedition camp; the two parties held a long conversation based on gestures and exchanged items. Gilbert was worried that the Aborigines would try to storm their camp, as there were only four expedition members guarding it, and he spent much time trying to distract them by riding his horse about, or by showing them the whiteness of his arms and legs. Gilbert wrote extensively about these tribesmen (dubbed "The Lotus Eaters" or "Lotophagi" by Leichhardt) in his diary over the two days they were at Reedy Brook Camp.[215]

Gilbert also made extensive observations on birds while at this camp site, and collected specimens of Sharp-tailed Sandpiper (*Calidris acuminata*), Red-kneed Dotterel, Varied Triller (*Lalage leucomela*), White-cheeked Honeyeater, and Zebra Finch (*Taeniopygia guttata castanotis*). He also collected a "*Calamoherpe*"—a Clamorous Reed-Warbler (*Acrocephalus stentoreus*)—the first record for the expedition.[216] Plum-headed Finches and Black-throated Finches were also common.

Disaster befell them at this time as, while out scouting near their camp of 3 May, Roper's horse, Bobtail, broke a leg and the whole party had to return the way they had come, taking a difficult short-cut over a ridge of basalt, which cut at the feet of the remaining animals. The horse had to be shot and they decided, after much soul-searching, to prepare it in the same way that they had with the cattle. Gilbert waxed lyrical on the importance of the "fine noble" horse to his "master and friend," but nevertheless joined most of the other expedition members in eating horse for supper that night.

While the rest of the expedition dried strips of Bobtail, Gilbert and Charley explored to the north-east, and came across an extensive system of lakes, almost all of which were decorated with the blue flower of the lotus. The largest lake was at least four miles (6.4 km) in circumference[217] and covered with water birds—pelicans, ducks, herons, and plovers. Inhabiting the dry flats surrounding the lakes were Australian Bustards, Singing Bushlarks (*Mirafra javanica horsfieldii*), and "the large species of Cincloramphus" (presumably the Brown Songlark *Cincloramphus cruralis*).

The Burdekin north of here began to split into numerous anabranches. On 9 May the main party moved through this confusing area and camped on the Burdekin just north of the two Pelican Lakes. Here they were again visited by the Lotus Eaters, who were becoming more daring and even threw a few spears in their direction. There were well-beaten tracks in all directions and it was obviously a favoured spot for the Aborigines. Gilbert mused on how annoyed they would be if in the future Europeans tried to settle on this beautiful spot.

On 11 May the expedition found that the River Burdekin was beginning to bend to the south and east, and regretfully decided they must leave it and strike off to the north. In the meantime they decided to stop and dispatch another steer, and camped that night on an open forest flat at a point where the Burdekin ran slowly over loose sand; it was nearly 200 yards (183 m) wide. They called their temporary home "Whitsunday Camp." Over the four days they camped there they were visited by large numbers of their "Lotophagian neighbours," including women and children, all agog to see these white men with their strange clothes. They exchanged gifts and the Lotus Eaters even entertained the expedition members with a corroboree, giving a romantic picture as they danced on the banks of the Burdekin under a natural arch of drooping *Melaleuca* (paperbarks), and against a backdrop of dark *Allocasuarina*, green grass, and reeds.

On 15 May Gilbert made a long list of the birds he saw in the area around Whitsunday Camp, which included several of particular interest as they are not found there today. Square-tailed Kites are now rare in Queensland. The presence of Spotted Harrier (*Circus assimilis*), Tawny Grassbird (*Megalurus timoriensis oweni*), Clamorous Reed Warbler, Cisticolas (*Cisticola* sp.), Brown Songlark, and Singing Bushlark indicates there was much better ground cover at that time than there is today. Also of note are Gilbert's possible records of Masked Owls (*Tyto novaehollandiae*) and Powerful Owl (*Ninox strenua*). Gilbert does not seem to have actually collected any specimens; he must have been too worried about the Aboriginal presence and the consequences of firing his gun. On the 16th the members of the Leichhardt Expediton broke up their camp and headed north up a sandy creek, from which they could see gigantic ant hills—hence their "Big Ant-hill Creek." The camp that night, "Lagorchestes Camp," refers to a kangaroo that their one remaining dog killed.[218]

On 17 and 18 May most of the party stayed in camp while Leichhardt investigated the interesting geology of the area,[219] but on the 19th they made a huge stage of 20 miles (32 km) over plains and around partly dried-up lakes, the longest distance they had ever travelled in one day. On their day's march Gilbert noted a clump of trees underneath which were four bowers of the *Chlamydera* built so close to each other that they were practically touching; he mused on whether this was the work of one or more bowerbirds. Large yellow *Helix* shells were artfully arranged around each bower.

On 23 May the expedition reached a large river which Leichhardt had found while out scouting; he called it after his friend Robert Lynd.[220] It was Queen Victoria's birthday and in her honour they celebrated with fat cake of flour and suet and had the last of the sugar in their tea. Passage along the Lynd through an increasingly mountainous area was terribly hard, with lava flows and grotesque forms of boulders littering their path. On the 27th Gilbert saw his first Galah (*Cacatua roseicapilla*) of the expedition and noted that he had seen many Apostlebirds (*Struthidea cinerea*) over the previous few days, the latter birds associated with the cypress pines (*Callitris* sp., probably *intratropica*). They stopped for four days to kill and prepare another bullock, with kites and crows playing "sad havoc" with the strips of meat as they dried.

Early June found them still struggling along the Lynd. Gilbert was so pre-occupied with the difficulties of their path that he had little time for birding, although he did note large flocks of Cockatiels and Galahs. White-browed Woodswallows had also re-appeared, and the presence of many ducks, ibises, and cormorants made Gilbert suspect there was much open water nearby.

On 2 June 1845, Gilbert collected the first specimens of a new finch, on which John Gould later based his description of *Poephila leucotis* (now known as the Queensland form of the Masked Finch *Poephila personata leucotis*).[221] Gilbert recorded that the bird fed on grass seeds in open spots of country. As a rather nice confirmation of Gilbert's discovery, an original watercolour by John Gould of the Masked Finch still exists (produced as the sketch for his published plate in *The Birds of Australia* 1840-1848, vol. 3, plate 92), on which is written in pencil "Poephila, discovered by Mr Gilbert on June 2nd 1845. Port Ess. Exp." This painting is now in the Library at Knowsley Hall, eight miles (12.8 km) east of Liverpool, seat of the great aristocratic naturalist Edward Stanley, 13th Earl of Derby, who—as previously mentioned—purchased many of Gould's zoological specimens and paintings. The earl's zoological collections founded the Liverpool Museum, but most of the 13th Earl of Derby's priceless collection of books and original artwork remain at Knowsley.

On 5 June the members of the Leichhardt Expedition followed the River Lynd where it turns off more to the west while passing Mount May. Gilbert saw his first Pink-eared Duck (*Malacorhynchus membranaceous*) of the expedition and also recorded a Black-breasted Buzzard (*Hamirostra melanosternon*). The next day he killed two Radjah Shelduck and recorded his first Spinifex Pigeon (*Geophaps plumifera*), which he had previously known only from the single specimen sent back to England by Benjamin Bynoe of H.M.S. *Beagle*, who had collected it at the Victoria River. Gilbert noted the pigeons behaved in a similar fashion to "the other two" (presumably the Squatter Pigeon and Crested Pigeon *Ocyphaps lophotes*), travelling in small flocks and feeding on the ground, and squatting when approached. However, unlike Squatter Pigeons, the Spinifex Pigeons did not fly into a tree when disturbed, but headed for termite hills, earth mounds, or a stone; they never seemed to perch. Gilbert collected two more Spinifex

Pigeons on 9 June[222] and shot more on the 10th, when he saw them "in great numbers." He also noted more individuals of his new yellow honeyeater (the Yellow Honeyeater)[223] and robin (the White-browed Robin) and recorded several other honeyeaters that were common. Brown Honeyeaters (*Lichmera indistincta ocularis*) were particularly abundant all along the Lynd, entertaining Gilbert with their pleasing song.

As well as the two specimens of Spinifix Pigeon, Gilbert collected an individual of another interesting bird, a treecreeper, on 9 June. He thought it was of a species which had been another of Benjamin Bynoe's discoveries, the Black-tailed Treecreeper (*Climacteris melanura*), but it was actually from an undescribed form (Figure 15). In 1846

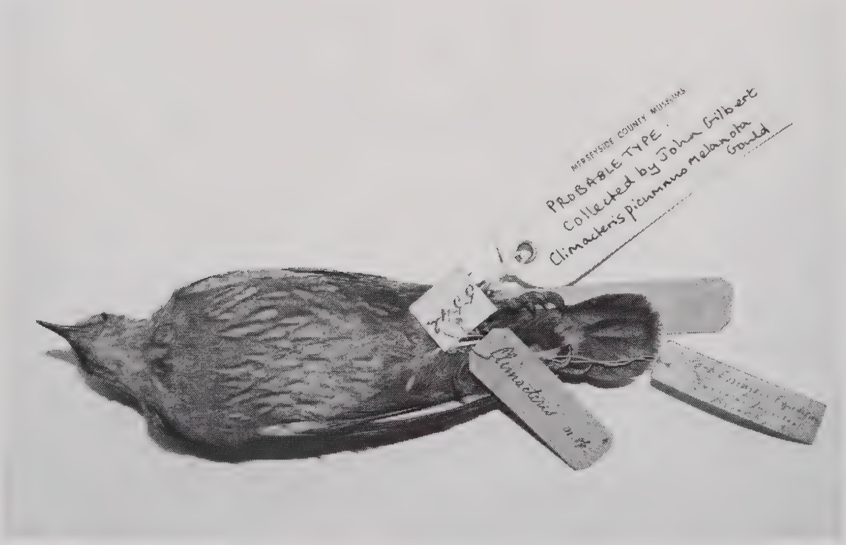
MERSEYSIDE COUNTY MUSEUMS
PROBABLE TYPE.
Collected by John Gilbert
Climacteris picumnus melanota Gould
Climacteris

Figure 15. Gilbert collected another new bird species on 9 June 1845, not long before he was killed. John Gould later named this species *Climacteris melanota*, a name which is now applied to the northern Queensland subspecies of the Brown Treecreeper, a form often known as the Black-backed Treecreeper. Gould assumed incorrectly that Gilbert had collected his specimens of this bird on the Mitchell River, in Cape York Peninsula. A specimen now in National Museums Liverpool (LIVM D.5542s, collected by Gilbert in June 1845 on the River Lynd) helps prove that the first specimens of this treecreeper were, in fact, collected much further south.

Gould used Gilbert's treecreeper material from the Lynd River in his description of *Climacteris melanota*; this name is now applied to the northern Queensland subspecies of the Brown Treecreeper (the Black-backed form, *Climacteris picumnus melanota*). However, Gould did not read Gilbert's diary carefully and did not realise that Gilbert's reference to "*Climacteris melanura*" on 9 June actually alluded to collecting the first specimen of this new treecreeper. Gould therefore wrongly assumed that the specimens must have been collected on the actual date of Gilbert's death, when they were much further north near the Mitchell River.

Actually Gilbert's only diary entries where he mentioned collecting specimens of treecreepers were those of 9 and 13 June 1845, when they were on the River Lynd—in other words all his material of *Climacteris picumnus melanota* was collected on the Lynd, not the Mitchell River. Thus the type specimens for the form *Climacteris melanota* are birds collected much further south than Gould (and subsequent authors) supposed.[224]

On the 11th, a day when they had travelled almost due north along the Lynd and were worrying about where it was taking them, Gilbert came across more new birds for the expedition. These were White-gaped Honeyeaters and what he thought were Wandering Whistling-Ducks, but from a description Gilbert wrote on the 12th, they were probably Plumed Whistling-Ducks (*Dendrocygna eytoni*). This is supported by the fact that two surviving Gilbert specimens of Plumed Whistling-Duck are labelled as having been collected on the River Lynd in June 1845.[225]

On the 12 June Gilbert killed the expedition's "First Microeca flavigaster," the Lemon-bellied Flycatcher, a species with which he had been familiar at Port Essington. His notes from that locality[226]give the impression Gilbert was rather fond of this bird, with its pretty and agreeable song but pugnacious manners. On the 15th Gilbert wrote in his diary that he had "killed for the first time in the expedition the true Cuculus, first killed by myself at Port Essington." He was probably referring to the Oriental Cuckoo (*Cuculus saturatus*).

On the 16th they came to a huge new river coming down from the north-east and into which the Lynd flowed. Leichhardt called it the Mitchell River, after Sir Thomas Mitchell, Surveyor-General of New South Wales and his rival explorer (perhaps hoping it would smooth ruffled feathers on their return, should they be successful in crossing

Australia). For the next three nights they camped beside a long thin lagoon (now called Highbury Lagoon; their camp site was just at the end of what is now a Station airstrip). They settled there in order to process their eighth steer, but spirits were lowered by the news that John Murphy's pony, a great favourite with everyone, had been found dead (the theories, never resolved, included snake bite and poisonous plant).

While they were camped, Gilbert was able to go out fishing and watching birds, and was surprised to see what he thought was his "new Platycercus of the Downs," which he had not recorded since they left Comet Creek. He listed the parrot again on 20 and 24 June, when they were much further north. It is a pity he did not collect any specimens, for these are extremely well-discussed records—most modern naturalists think Gilbert was making a mis-identification of the Golden-shouldered Parrot (*Psephotus chrysopterygius*), which he had never seen before (and which indeed was not formally described until 1858).[227] It seems strange that Gilbert, who must have spent hours poring over his Paradise Parrot specimens from the Darling Downs, and had physically prepared at least six specimens, could have mistaken the yellow-winged Golden-shouldered Parrot for the red-winged Paradise Parrot, particularly as he obviously saw this mysterious parrot several times and in large numbers on the Mitchell River. However, Gilbert did not have the luxury of binoculars, and the Golden-shouldered Parrot is an extremely shy bird that he obviously did not get near enough to shoot.

Gilbert made a list of the birds he had seen while camped at the lagoon, which apart from his enigmatic "Platycercus (New)" included his new subspecies of Masked Finch and Flock Bronzewings—substantially east of their present range. He also recorded Red-tailed Black-Cockatoo, which was probably the cockatoo he had noted as "Calyptorhynchus . . . ?" at Whitsunday Camp on 15 May.

Over the next few days, as they marched on over fine grassy country, parallel to the Mitchell River, Gilbert recorded large flocks of Flock Bronzewings, Cockatiels, Budgerigars (*Melopsittacus undulatus*), Galahs, and big flocks of two species of finch, his new "*Poephila*" (the Masked Finch *Poephila personata leucotis*) and Black-throated Finches. Other finches were common too. The Cockatiels were incredibly abundant, passing him in great flocks all the way along the route, and there were countless numbers of Bronzewings "some of the flocks when rising resemble the roar of distant thunder so great was their numbers." There were also vast flocks of White-browed and Black-faced woodswallows. Gilbert also saw a Crested Bellbird, which today is found well south of this area.

At this point Gilbert ran out of room in his second diary volume, and returned to using the first, writing over his pencilled natural history notes. He had already entered some scribbled notes and numbers from the Leichhardt Expedition, mainly daily mileages, and then resumed his account of the expedition on 23 June 1845, when they were travelling over swampy ground. Here Gilbert collected a series of birds, two of which he thought were new species: "First *Mimeta.* First new *Ptilotis pectoralis* . . . banded *Ptilotis.* First new *Ptilotis* like *fusca.*" The "*Mimeta*" must have been an Olive-backed Oriole (*Oriolus sagittatus*), the first for the expedition (although Bruce Lawrie recorded this species at all five of the Leichhardt Expediton camp sites which he re-visisted). The two honeyeaters are more difficult to identify, but perhaps a clue is a specimen now in the Natural History Museum's collections at Tring, an immature Banded Honeyeater (*Certhionyx pectoralis*) collected by Gilbert "Near Gulf of Carpentaria. June 1845."[228] Gilbert had only previously seen this species at Port Essington.

As for the "First new *Ptilotis* like *fusca,*" Gillbert thought it similar but much lighter in colour than the Fuscous Honeyeater, with more yellow about the head and smaller in size, a description which fits the closely-related Yellow-tinted Honeyeater (*Lichenostomus flavescens*). Unfortunately, none of Gilbert's Mitchell River specimens of his "*Ptilotis* like *fusca*" can be found to check this theory. This might be explained by an account Gilbert wrote in his diary on 27 June:

> "The Milvus isurus [Square-tailed Kite] is on the increase as well in numbers as in boldness. In the afternoon while sitting at the entrance of my tent skinning birds, I had a tin case with specimens between my legs, the lid of which I had opened to air the specimens enclosed; among which was the only specimen of my last new Honey sucker. This was lying on the top and had deceived the bird so much that he darted down, and to my surprise & vexation fairly carried off my specimen, and flying into a neighbouring tree, instantly plucked it in pieces, whether he swallowed any I could not tell, but at all events I should imagine that the Arsenic will not at all agree with its stomach, although they display so little nicety in what they pick up."

On 25 June the expedition had left the Mitchell, realising it was taking them too far to the north, and struck out west across the flood plains. They were still seeing large flocks of Flock Bronzewings and Gilbert collected his first Spectacled Monarch (*Monarcha trivirgatus*) of the expedition, another record from the Leichhardt Expedition of a species far out of its modern range, but unfortunately this specimen has not been found.

For most of this period they were shadowed by Aborigines, whose fires they could see in all directions, and there is some evidence that adverse contact occurred between some members of the expedition (notably their two Aboriginal trackers) and the tribesmen (and their wives) which the expedition members came across. Gilbert wrote that Charley had a tendency "not to be very particular in his treatment of a Native woman if he caught one." On 28 June 1845 the party camped for the night on the floodplain formed by the Nassau River. Gilbert wrote up his diary for the day, musing deeply about the Aborigine presence:

> "During the days march we passed many rings of fires, made by the Natives, doubtless for the performance of some one of their extraordinary ceremonies, the inner space in all are perfectly bare, and the small fires forming the ring are about a foot apart, in some I counted ten in others 12 fires. Around them at a little distance are round heaps of stones sunk in a slight hollow of the ground, where they appear to have been engaged in cooking their food, and pieces of Bark or Boughs showing that it has been a regular camping ground. but what the ring is for would be very interesting to know perhaps in some way connected with their superstitions."

Gilbert put his diary away, and then he and Murphy experimented with plaiting palm leaves to make a new hat. The Leichhardt Expedition members then retired for the night, leaving no-one on guard duty; soon afterwards they were attacked by Aborigines. Murphy, Charley and Brown managed to reach their guns and beat off the attack, but not before Gilbert, stooping to get out of his tent, was hit in the neck by a spear. He summoned up the strength to hand Charley his gun, but then collapsed and died almost immediately.

Leichhardt could not find Gilbert's wound at first, it was so small —the spear must have pierced the carotid artery. Roper and Calvert had also been seriously wounded, by six and five spears respectively, and at least one of the attacking Aboriginals had been badly hurt or possibly killed; they heard wailing and later found trails of blood as if a body had been dragged away.

The next afternoon Gilbert's body was buried in a grave hurriedly dug by the remaining members of the expedition; the ground was so hard and they had so few suitable tools that the grave only reached a depth of 3½ feet (1 m). After interring Gilbert and reading the burial service, they lit an immense fire over the grave to disguise it. The exact location of Gilbert's grave today is uncertain, although a possible site (which showed traces of carbonisation) was marked by a joint expedition between James Cook University, the University of New England at Armidale and the Australian army in the early 1980s. Continued efforts to confirm the spot are being made.

On 1 July 1845 the remaining members of the Leichhardt expedition moved off, travelling as fast as possible (even though Roper was in such pain he sometimes had to be carried) as they feared another attack. At a waterhole on a branch of the Staaten River Leichhardt threw all their spare horseshoes into the water; they had been keeping them for presents for the Aborigines, but henceforth would try and avoid all contact. A few days after Gilbert's death, Leichhardt named a major river in Cape York after him (although quite possibly this river was the Smithburne, a tributary of what is officially now the Gilbert River).

Over the next few months Leichhardt and the rest of his party meandered up and down the rivers of the Gulf of Carpentaria, naming the Nicholson River just before crossing into what is now Northern Territory. The name "Seven Emu River" gives an idea of the sort of food they were now relying on (at one point they experimented with adding green animal hide to wallaby stew). Leichhardt named the Calvert River after his still painfully affected expedition member. Further north they camped under a dissected mesa with four peaks, which Leichhardt called The Four Archers after David, Charles, John, and Thomas Archer, squatters of Moreton Bay. In October 1845 Leichhardt named a huge, broad river after John Roper. It was lined with Red Cabbage Palms (*Livingstonia rigida*), which were beautifully mirrored in the waters, but was the unfortunate scene of a series of calamities. Three of the horses rushed into the river to drink and were drowned; Leichhardt had to abandon his botanical collection, as well as a smaller one made by Gilbert, which one of the horses had been carrying. Another horse was drowned as the expedition members tried to cross the river. Only a mile

(1.6 km) further on they discovered a good crossing (now known as Leichhardt's Roper Bar).

Snowdrop Creek, now in the Arnhem Land Aboriginal Reserve and one of the tributaries of the Katharine River, refers to the bullock they slaughtered there. Sandstone escarpments rose in all directions and deeply fissured land lay in front; at the edge of a plateau they found themselves on the edge of a tremendous precipice. After days of scouting they found a way to descend, probably in the region of spectacular Jim Jim Falls, although it is difficult to see anywhere they could possibly have climbed down. Wearily they crossed the immense plain of the East Alligator River with their one remaining bullock, and on 17 December 1845, the small band of ragged men arrived at the settlement of Victoria, Port Essington. Despite all their trials and tribulations, the remaining members of the Leichhardt Expedition had sturdily carried most of John Gilbert's collections and his journal with them[229] and Leichhardt eventually was able to send them to John Gould in London. The rest, as they say, is history.

This chapter has given much detail about Gilbert's work as a natural historian, but what of his character? The personal lives and personalities of working-class people in the early Victorian period are not well documented. No portrait of John Gilbert has ever been identified, although we can glean a sketchy outline from various sources. Mrs. Brockman's description from Gilbert's time in Western Australia helps; we know he was dark, short, and somewhat spare, and that he was an industrious and cheery person who never stopped trying to add to his bird collection.

Gilbert led a surprisingly rich scientific life for a man with such humble origins. Although his spelling is sometimes eccentric, Gilbert wrote freely and well; take this rendition of the voice of the Musk Duck (*Biziura lobata*):

> "They have but a single note which is singular, it resembles the sound caused by a large drop of water falling into a deep well, or it may be imitated by the sudden opening of the lips."[230]

Gould himself, a man not prone to false praise, wrote in a letter to Lord Derby that:

> "Mr Gilbert is . . . no ordinary collector, as you would admit were you to see the specimens just received from him; he is, moreover,

> most honorable and upright in all his dealings and no one can be more ardent and enthusiastic in his pursuits than himself."[231]

Gilbert was a good shot, an experienced bushman, and careful observer, and a brilliant taxidemist whose specimens can often be picked out in a drawer just by looking at their excellence compared to the others.[232]

Gilbert was married at least once, and there is a possibility that his first wife was a widow who he married when aged 17. Of his relationships with others, little is known, although Gilbert did not suffer fools or pomposity lightly, and his relationship with Leichhardt seems to have often been difficult. However, Gilbert made some good friends, like James Drummond and John Murphy, and most people seemed to speak well of him. Captain John Lort Stokes of H.M.S. *Beagle*, who had met Gilbert in Western Australia, was grief stricken at Gilbert's death, and wrote that:

> "I know of no person . . . among our small community so much regretted by all . . . when I look at the seat he occupied at my table & fire side I think of the few spare hours he used to afford himself and the pleasure I always found in his Society . . . a Genuine Character & a great favorite with all who knew him."[233]

CONCLUSIONS

John Gilbert, a working-class Englishman, collected the first specimens known to science of at least 8% of all Australian bird and mammal species and subspecies, these forms amounting to over 80 birds and at least 30 mammals. He was also responsible for discovering many new reptiles, amphibians, fish, molluscs, insects, and plants. A large number of the specimens Gilbert collected represent forms now extinct or endangered, and many were collected in areas where they no longer exist—making them today, of extreme importance for research on faunistic distribution.

John Gilbert's manuscripts (which include field details of immeasurable importance) and specimens are still actively researched—his collections from Western Australia, Port Essington (Northern Territory) and those from the Port Essington Expedition (First Leichhardt

Expedition), Queensland, being of particular importance. Gilbert's most important ornithological discovery was undoubtedly the now-extinct Paradise Parrot, and his specimens of this beautiful parrot are now of enormous interest.

One hundred and sixty years after his death, John Gilbert's name is finally being established beyond doubt as belonging to the most important collector of higher vertebrates in the history of Australia.

Apart from the geographical features named after John Gilbert during the Leichhardt Expedition (Gilbert's Dome, Peak Range; Gilbert's Range, Dawson Valley; Gilbert Range, Lynd Valley; Gilbert River and Gilberton, Cape York Peninsula), there are monuments to Gilbert at the Noisy Scrub-bird site at Drakesbrook in Western Australia and at many sites along the Leichhardt Expedition route—such as at "Gilbert's Lookout" in Taroom. There is also a marble tablet commemorating Gilbert in St. James Church in Sydney. Many animals and plants bear his name, such as:

- Gilbert's Dragon *Lophognathus gilberti* J. Gray, 1842 (lizard)
- *Pingalla gilberti* Whitley, 1955 (fish)
- *Helix gilberti* (Pfeiffer, 1845) (mollusc)
- *Hipposideros bicolor gilberti* Johnson, 1959 (bat)
- *Sminthopsis gilberti* Kitchener, Stoddart & Henry, 1984 (dasyurid marsupial).
- Gilbert's Potoroo *Potorous gilberti* Gould, 1841 (rat kangaroo)
- *Acacia gilbertii* Meissner, 1848 (Western Australia) (wattle)
- *Clematis gilbertiana* Turcz. 1854 (vine)

Modern scientific names of birds that are known to have been called after Gilbert are:

- *Ardea sumatrana gilberti* Mathews, 1912 (heron)
- *Megapodius cumingii gilbertii* Gray, 1861 (scrubfowl)
- *Anous stolidus gilberti* Mathews, 1912 (noddy tern)
- *Eurostopodus argus gilberti* Deignan, 1950 (nightjar)
- Gilbert's Whistler *Pachycephala inornata gilbertii* Gould, 1844

Gregory Mathews also named the whistler genus *Gilbertornis* (now part of *Pachycephala*) in 1912.

Acronyms used:

ANSP: Academy of Natural Sciences, Philadelphia, U.S.A.
CALM: Department of Conservation & Land Management, Western Australia.
CNL: National Library of Australia, Canberra.
CUMZ: Cambridge University Museum of Zoology, U.K.
LIVM: National Museums Liverpool, U.K. (stored in the Richard Foster Wing of World Museum Liverpool, formerly Liverpool Museum).
MCZ: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, U.S.A.
MLS: Mitchell Library, Sydney, Australia.
MNHN: Muséum national d'Histoire naturelle, Paris, France
NHM: The Natural History Museum, U.K. (lower vertebrates and mammals stored in South Kensington, London; birds in the outstation in Tring, Hertfordshire).
QML: Queensland Museum Library, Brisbane, Australia.
RAMME: Royal Albert Memorial Museum, Exeter, south-west England.
RMNH: Nationaal Natuurhistorisch Museum (*Naturalis*) Leiden, Netherlands.
SPL: Shrewsbury Public Library, Shropshire, U.K.
TMI: Turin Museum, Italy.

Letters and manuscripts consulted:

Brisbane, Australia, Queensland Museum Library.
Gilbert's manuscript note-books:

- John Gilbert's *note-book on Marsupialia.*
- John Gilbert's *Ornithological Notes* (2 vols).
- John Gould's *Ornithological Notes and instructions to collectors.*

Cambridge University Library, U.K., Manuscripts Section.

- John Gilbert and John Gould's manuscript notes for Gould's *Birds of Australia*.

Canberra, National Library of Australia.

- John Gould to John Gilbert, letter of instruction, dated 29 January 1839.
- List of specimens sent home by John Gilbert from Perth on the *Shepherd*, dated 1 January 1840.

Liverpool, U.K., Liverpool City Libraries, Local History Library.

- John Gilbert to John Gould, letter dated 2 January 1843.
- John Gilbert to John Gould, letter dated 18 April 1843.
- Copy by the 13th Earl of Derby of a letter from John Gilbert to John Gould, dated 8 June 1844.

Liverpool, U.K., National Museums Liverpool, Archives Department.

Copies in the 13th Earl of Derby's Copybook:

- John Gilbert to John Gould, serial letter starting 13 September 1842.
- John Gilbert to John Gould, letter dated 27 March 1843.

London, the Natural History Museum, General Library (Gould Collection).

- John Gilbert's manuscript field species lists for Western Australia and the Cobourg Peninsula.
- Draft letter from John Gould to the 13th Earl of Derby, September 1843.
- Frederick Strange to John Gould, letter dated 22 February 1844.
- Frederick Strange to John Gould, letter dated 4 June 1844.
- Frederick Strange to John Gould, letter dated 20 July 1844.
- Charles Coxen to John Gould, letter dated 1 October 1844.
- John Lort Stokes to John Gould, letter dated 27 June 1846.

Shrewsbury, U.K., Public Library.

- John Gilbert to Shropshire & N. Wales N.H. & Antiquarian Society, letter dated 7 March 1837.
- John Gilbert to Thomas Eyton, letter dated 30 March 1838.

Sydney, Australia, State Library of New South Wales, Mitchell Library, Manuscripts Department.

- John Gilbert's diary from March-September 1844, and from the Port Essington Expedition (first Leichhardt Expedition), October 1844 to June 1845. 2 vols.
- William Phillips and John Murphy's diaries from the Port Essington Expedition.
- John Gould to Kerr Alexander & Co., Launceston, letter dated 21 January 1839.
- John Gilbert to John Gould, letter dated 15 March 1839.
- John Gilbert to John Gould, letter dated 11 April 1839.
- John Gilbert to John Gould, letter dated 3 September 1839.
- John Gilbert to John Gould, letter dated 4 January "1839" [=1840].
- John Gilbert to John Gould, letter dated 4 May 1840.
- John Gilbert to John Gould, letter dated 16 July 1840.
- John Gilbert to John Gould, letter dated 19 September 1840.
- John Gilbert to John Gould, letter dated 17 September 1841.
- John Gilbert and John Gould, agreement covering second trip to Australia, dated 31 January 1842.
- John Gilbert to John Gould, letter dated 5 February 1842.
- John Gilbert to John Gould, letter dated 15 December "1842" [= 1843].
- John Gilbert to George Bennett, letter dated 10 September 1844.

Toowoomba, Queensland, Lionel Lindsay Gallery & Library.

- John Gilbert to Frederick Strange, letter dated 16 September 1844.

ACKNOWLEDGEMENTS

I have extensively referred to the work of Australians Bruce Lawrie and Ian McAllan, and in some cases have used their unpublished material; they have both been extremely generous with information and have also reviewed this chapter. Ian's fortitude in reading Gilbert's pencil script in his diary for the period before he joined the Leichhardt Expedition is truly remarkable.

Richard Schodde and Leo Joseph (CSIRO Canberra) have advised on many nomenclatural and faunistic matters. Alan Danks (CALM) has over the years helped me greatly with Gilbert's travels and collections in Western Australia; Alan also made it possible for me to actually hold a Gilbert's Potoroo while it was having a blood sample taken, and at least *hear* a Noisy Scrub-bird. Harold Cogger and Andrew Burbidge identified Gilbert's bird-eating lizard of the Houtman's Abrolhos. Robert Prys-Jones, Mark Adams, Douglas Russell, Jo Cooper and James Maclaine (NHM), Ray Symonds and Adrian Friday (CUMZ), Nate Rice (ANSP), René Dekker and Christiane Quaisser (RMNH), Claire Voisin (MNHN), Jeremiah Trimble (MCZ) and Wayne Longmore (Museum Victoria, Melbourne) have all researched specimens in their collections for me. Leo Joseph and Tom Wilke produced the map of Gilbert's collecting localities (see figure 3).

Hugh Torrens generously gave me all his material on John Gilbert's time in Shrewsbury. Many librarians have helped with access to manuscript material concerning John Gilbert: in particular those of Liverpool City Library, U.K.; the General Library of the Natural History Museum, U.K.; Cambridge University Library, U.K.; the Mitchell Library in Sydney, Lionel Lindsay Gallery & Library, Toowoomba, Queensland and Queenland Museum Library, Brisbane. I am also indebted to the 19th Earl and Countess of Derby, of Knowsley Hall, and their curator Emma Tate, who have allowed me access to Knowsley Hall Library on many occasions.

The Royal Geographical Society of Queensland took me on their expedition to retrace the Leichhardt Expedition in 1990. Taroom Town Council, Queensland, arranged for me to take part in their Leichhardt Expedition Exposition of 2004 and Charters Towers Council invited me to their Leichhardt Expedition Rally in 2006. Glen McLaren most generously provided me with a copy of all three volumes of his thesis, based on his re-tracing of the entire route of the Leichhardt Expedition in the early 1990s. Ian and Sue Flinders have for the last few years helped organise and facilitate all my Leichhardt Expedition trips. My thanks go to all of them.

Over the years I have been awarded several grants from the Research Fund of National Museums Liverpool (NML), and from the Peale Foundation in Philadelphia, to research the life and collections of John Gilbert, John Gould, and other Australian collectors of the period

1838-1850, for which I am most grateful. NML have also allowed me several periods of time to visit other museums in order to research their Australian material.

I dedicate this chapter to the memory of two gentlemen who helped me greatly over many years, who were both enormously entertaining, and who I miss: the Australian mammalogist and historian Dr. John Calaby, and the world expert on John Gould, the American Dr. Gordon Sauer.

ENDNOTES

[1] John Gould stated in his account of "*Gilbert's Rat Kangaroo*" in *The Mammals of Australia* (volume 2, text to plate 69, 1845-1863) that he was dedicating his account of this new species to "the late Mr Gilbert, who proceeded with me to Australia to assist in the objects of my expedition, I embraced with pleasure the opportunity afforded me of expressing my sense of the great zeal and assiduity he displayed in the objects of his mission … science is indebted to him for the knowledge of this and several other interesting discoveries."

[2] Edward Wilson purchased Gould's Australian bird collection for his brother Thomas B. Wilson, of the Academy of Natural Sciences in Philadelphia, in 1847.

[3] Now in National Museums Liverpool (LIVM D.937s).

[4] The teal and eagle are both in the Natural History Museum, London (1841.1316 & 1841.1269)

[5] National Museums Liverpool (LIVM D.781).

[6] Natural History Museum, London (NMH 1841.1314).

[7] The lectotype of *Scotophilus* (now *Chalinolobus*) *gouldii* Gray, 1841 is NHM 1841.1516, from Launceston (lectotypic designation by Thomas 1905, see Walton, 1988).

[8] Examples of their collections on the Bass Straits Islands include the following: Gilbert collected a Silver Gull (*Larus novaehollandiae*) on Chalky Island on 11 January 1839 (NHM 1841.1303) and a Ruddy Turnstone (*Arenaria interpres*) on Isabella Island on 12 January 1839 (NHM 1881.5.1.5856). Gould collected eggs of the Black Swan (*Cygnus atratus*) (see his *Handbook* 1865, vol.2: 350) and Gilbert a Hooded Plover (*Thinornis rubricollis*) (NHM 1841.1352, 17 January 1839) on Flinders Island.

[9] Gould referred to this accident in a letter from Georgetown, dated 20 January 1838, to his wife in Hobart (Mitchell Library Sydney MS A172), see Sauer 1982:109.

[10] One exception to this was this new species *Diomedea cauta*, the Shy Albatross, described by Gould in 1841. Gould and Gilbert collected the type specimens of this oceanic bird off the coast of Tasmania. These important specimens are now in three different museums (NHM 1841.1288 (Bass Straits), RMNH 87009 (Recherche Bay) and ANSP 4518 / VN 1638). Another new species they discovered was the Fairy Tern *Sterna nereis*, described by Gould in 1843 from a male bird (ANSP 4908 / VN 1778) which he and Gilbert had collected in the Bass Straits in 1839.

[11] Letter from Gilbert to Gould from Perth, 15 March 1839 (MLS Gould papers vol.2, letters 1838-1861).

[12] Letter from Gilbert to Gould from Perth, 11 April 1839 (MLS Gould papers vol.2, letters 1838-1861).

[13] Letter to Gould of 11 April 1839, as above.

[14] The type series of *Acanthiza inornata* Gould, 1841 probably includes ANSP 17581, ANSP 17580 and NHM 1881.2.18.206, collected by Gilbert at Swan River on 11 March 1839. This latter specimen was sold by Gould to Thomas Eyton and was purchased by the British Museum when Eyton's museum was sold after his death. Of Gilbert's specimens that have been found so far, it is the earliest type specimen from his time in Western Australia.

[15] This is in the collections in Philadelphia, but it is not from the Gould Collection. In the late nineteenth century Canon H. B. Tristram's huge collection of birds was purchased by the Liverpool Museum, but the "duplicates" went to the Academy of Natural Sciences in Philadelphia. The White-naped Honeyeater Gilbert collected on 13 March 1839, near Perth is one of these (now ANSP 53262), and is now considered a syntype of *Melithreptus chloropsis*, together with four specimens from the Gould Collection (ANSP 18300, 18301, 18303 & 18304). Another possible syntype is NHM 1841.1440, a Gould Collection adult specimen from Western Australia. It is worth noting that ANSP 18301, an immature female, was rescued in 1997 from the "specimens to be de-accessioned" (and presumably to be thrown in the dustbin) cupboard at ANSP, a bad enough decision given that it was a Gould Collection specimen, but even worse given that Gould clearly talks about birds in non-breeding plumage in his type description. Clearly the action of the 21st century Academy curators Leo Joseph and Nate Rice to dismantle this ruinous cupboard and return the contents to their rightful places in the collection is to be applauded.

[16] Letter dated 11 April 1839, see endnote 12. "*2 Brown Creepers*" (and a skeleton) were included on a list (dated 1 January 1840), of the specimens sent from Perth by Gilbert, aboard the *Shepherd*, to Gould in London (CNL MS 1465/24/7).

[17] At least three specimens are potential syntypes for Gould's name *Climacteris rufa*. Two are now in ANSP (9218 & 9217) but the third, a female that still bears Gilbert's original field label (recording that it was

collected near Perth on 30 March 1839) is now in Cambridge, UK (CUMZ 27/SIT/1/F/1), and was formerly in the collection of Hugh Strickland.

[18] Gould's name *Meliphaga mystacalis* had already been used by Temminck, so in 1872 Schlegel renamed this bird *Meliphaga gouldii* (now *Phylidonyris nigra gouldii*). Several of Gilbert's specimens have possible type status: ANSP males 18411 and 18412 (a third bird was sent to Philadelphia but was never registered and must now be considered as lost), NHM 1841.1093, a female collected by Gilbert near Perth on 15 May 1839, two females now in LIVM, both collected by Gilbert near Perth on 1 May 1839, and a pair of birds now in RMNH. Two birds which had just fledged (ANSP 18413 and NHM 1841.1499) may be the "young birds ready to leave the nest having been found [by Gilbert] on the 8th August," quoted in Gould's *The Birds of Australia* account (1840-1848, vol. 4, text to plate 26).

[19] Again Gould's name *Zosterops chloronotus* was too close to an existing one, and this species is now known as *Zosterops lateralis gouldi*, the new name reflecting the original author. The replacement name was published in 1851 by Napoleon Bonaparte's nephew, Charles, himself a distinguished ornithologist.

[20] See the entry for the "*Freckled Duck*," amongst Gilbert's manuscript notes now in Cambridge University Library, U.K. (Gould Collection Box 4d). In Gilbert's entry for "*Anas naevosa Gould*" in his *Ornithological Notes* (vol. 2: 629, QML) he stated that "the specimen [I] obtained at the Swan was a female, but the bird is so rare that no information could be gained of it either from the colonists or natives." Gilbert's female duck, which must have been obtained on his first visit to Western Australia, is probably a specimen now in ANSP (5918). Gould specified that he had seen just two specimens, the female sent to him by Gilbert and one in the Australian Museum. Perhaps the drake Freckled Duck in the Gould Collection in Philadelphia (ANSP 5917) is from Gilbert's second visit to Western Australia.

[21] From Gilbert's manuscript notes on "Macropus – Wau-rong" in "*Mammals of Western Australia. No 2*," species number 27 (Gould Collection, NHM General Library). The holotype of *Macropus lunatus* Gould, 1841 is NHM 1841.1131, a male collected by Gilbert at "Swan River."

[22] See endnote 12.

[23] NHM 1841.1210.

[24] LIVM D.3233.

[25] The last specimen from Gilbert's 1839 inland trip found so far is a Brush-tailed Bettong (*Bettongia penicillata*), collected at York on 20 June 1839 (NHM 1841.1144)

[26] *Petrogale lateralis* was described by Gould in 1842 from Gilbert's material. Gilbert's type specimens are NHM 1842.5.26.3 (male) and

1841.1120 (female), both from Swan River. His manuscript notes on "*Petrogale lateralis*" are in "*The Mammals of Western Australia. No.1*," species number 43 (Gould Collection, NHM General Library).

[27] The holotype of *Hypsiprymnus graii* Gould, 1841 (= *Bettongia lesueur graii*) is NHM 1841.1157, a male collected by Gilbert at "Swan River."

[28] Quote from Gilbert's manuscript notes in box 2 of the Gould Collection in Cambridge University Library, U.K. The types of *Ptilotis plumula* Gould, 1841 are in ANSP (18555 & 18556); another possible type is in RMNH. The NHM has a clutch of two eggs, collected by Gilbert at York on 7 October, but the year is missing and from Gilbert's chronology it could have been either 1838 or 1843. Interestingly, on Gilbert's second visit to Western Australia from 1842 to1843, he collected a Grey-fronted Honeyeater even further west, at "Wortham" [= Northam], on 18 August 1842 (LIVM T.13303, from the collection of Canon H. B. Tristram. The specimen was formerly in the museum of the Shropshire landowner Thomas Eyton, Gould's ornithological friend).

[29] The date and locality were recorded next to the entry for 1841.1129, *Lagorchestes* ?*Derbianus*, in the NHM Accession Register. This is actually a male Tammar Wallaby.

[30] Dr. Walker was Surgeon on George Grey's 2nd Overland Expedition. The excursion to Garden and Rottnest islands was discussed in a letter from James Drummond to the British botanist Sir William Hooker (see Whittell 1941: 123 and 1949: 38). The name "Rottnest" is derived from "Rat's nest," and refers to the Quokkas (*Setonix brachyurus*) that inhabit the island.

[31] MLS Gould papers vol. 2, letters 1838-1861.

[32] Now known as the Malleefowl (*Leipoa ocellata*), which Gould described in 1840 from material from the Swan River, Western Australia. There has been endless dispute about the present location of the type specimen. The two specimens at ANSP that were listed as "cotypes" by Meyer de Schauensee (1957) are both labelled "South Australia," which is not the type locality. A possible candidate is a male Malleefowl now in MCZ, a Gould Collection specimen from "Interior of West Australia … said to be a male. Killed near Botherling" (MCZ 83871, received from Baron Lafresnaye). Gilbert devoted much time and thought to this fascinating megapode, and his observations on the bird during his second visit to Western Australia will be referred to later in this chapter.

[33] Date given in Gilbert's notes on *Dasyornis longirostris*; notes are now in CUL Gould Collection Box 5b.

[34] This is quite possibly the clutch of two eggs of *Dasyornis longirostris* in the Gould Collection, now in the NHM (1962.1.51).

[35] The specimens sent aboard the *Shepherd* left Perth on 1 January 1840 (CNL MS 1465/24/7). Gilbert's letter to Gould of 3 September 1839 is now in the MLS (Gould papers, volume 2). Unfortunately it is now impossible to tell whether the type specimen of *Dasyornis longirostris*

still exists. A specimen now in Philadelphia (ANSP 17689) from King George's Sound was listed by Stone (1913) as the holotype, but Gould had specified in his type description that the specimen in front of him was from Swan River. Gilbert had certainly not yet visited King George's Sound when he sent his "Djyrdalya" skin off on the *Shepherd.*

[36] The type specimens of *Euphema petrophila* Gould, 1841 are ANSP 22942, a male from "West Australia" and LIVM D.785a, a male Rock Parrot collected by Gilbert on Rottnest on 3 December 1839. Another male Rock Parrot from Western Australia now in the Gould Collection at RMNH (Old Collection Cat. No 1) was almost certainly collected by Gilbert and may also have type status.

[37] "Swan River. Nanodes petrophila. Rock Parrokeet" in Gilbert's manuscripts now in CUL (Gould Collection, Box 3d).

[38] On 1 January 1840 Gilbert collected a young Painted Button-quail *Turnix varia* at the Murray River (LIVM D. 3719).

[39] Gilbert described the events of this expedition in a letter he wrote to Gould from Western Australia on 27 March 1843, when he was visiting the colony for the second time (the only version of this letter now extant is a sadly incomplete copy by the 13th Earl of Derby, now in the Archives Department of LIVM: Earl of Derby copybook 3: 65-95, see Wagstaffe and Rutherford 1955:13). An account of this expedition was also written by William Clark of the Chief Secretary's department, C.S.O. 1842, cited in Chisholm 1973:31 and Whittell 1949:40-41).

[40] In Gould's *The Mammals of Australia* 1845-1863, vol. 2, text to plate 1.

[41] Gilbert's comments on Elegant Parrots at Kojonup were included by Gould in his discussion of this species in his *Handbook* (1865, vol.2:74). Gilbert said that he had shot "a great many," but that they were nearly all young birds. Gould also included Gilbert's comments about Red-capped Robins at Kojonup in the *Handbook* (vol. 1:281), as Gilbert had only ever "met with" this robin in two localities, Kojonup and York.

[42] Comment in a letter from Gilbert to Gould, from Sydney on 4 May 1840 (MLS MS 1465/24/7). Gilbert does seem to have collected a number of mammal specimens, however, in his time at King George's Sound in early 1840. Two were of subspecies new to science: the Western Australian forms of the Southern Brown Bandicoot, *Isoodon obesulus fusciventer* (Gray, 1841) and the Common Ringtail Possum, *Pseudocheirus peregrinus occidentalis* (Thomas, 1888). The holotypes of both species are now in the NHM (1841.1176 and 1841.1189 respectively).

[43] Gould's type description of *Hypsiprymnus gilbertii* was published in part one of his *A Monograph of the Macropodidae* (1841-1842), text to the last [15th] plate (1841). The holotype is a female now in the NHM: 1841.1152 (skin) & 1846.4.4.47 (skull), collected by Gilbert at King George's Sound, presumably at some point during the two weeks he was in the area in February 1840. Gilbert also collected specimens of

Potorous gilbertii when he returned to King George's Sound in 1843 (another female, NHM 1844.7.9.5 (skin) & 1844.10.30.12 (skull); LIVM D.232a, a male that is no longer extant and D.232b, an immature collected "in the vicinity of Albany" on 15 June 1843). Gilbert also collected living specimens of *Potorous gilbertii* which were sent back to John Gould in England; one died in the Earl of Derby's menagerie at Knowsley Hall, near Liverpool, in 1844 (LIVM D.232, a male which is no longer extant). There is also a Gould specimen of Gilbert's Potoroo now in MNHN (mount no. 140, received from Verreaux in May 1854), which was probably collected by John Gilbert. A pair of mounted *Potorous gilbertii* that were also possibly collected by Gilbert is now in RMNH.

[44] Gilbert's Potoroo Action Group Inc., P.O. Box 654, Albany, WA 6331; www.potoroo.org.

[45] Letter from Gilbert in Sydney to Gould in London, dated 4 May 1840 (MLS MS 1465/24/7. Also see Whittell 1942:221-223).

[46] Letter to Gould from Port Essington, dated 16 July 1840 (MLS Gould papers, vol. 2, letters 1838-1861).

[47] To the staunch John McArthur can be attributed the continued existence of the colony of Port Essington for eleven years despite the most difficult of circumstances: disease, white ants, bad weather, and isolation took their toll and the colony was finally abandoned in 1849. The settlement of Victoria, with its melancholy remains of living quarters, hospital, brick ovens, cannon, and gravestones, and the inlet of Port Essington are now part of the Gurig National Park on the Cobourg Peninsula.

[48] Gilbert's letter to Gould from Port Essington, dated 19 September 1840, is now in MLS (Gould papers, vol. 2, letters 1838-1861). Gould quoted Gilbert in *The Birds of Australia* 1848, vol. 2, text to plate 94, taking this passage from Gilbert's notes now in CUL, Gould Collection Box 5a. The types of *Microeca flavigaster* are probably ANSP 566 (F), 567 & 568 (both males), NHM 1858.12.2.17 (adult unsexed), RMNH Old Collection (immature male) and LIVM D.3914s, the male bird collected by Gilbert at Port Essington on 21 July 1840.

[49] Warren and Harrison (1971:436) designated this specimen, which is now in the Gould Collection at the NHM (1881.5.1.1255), as a syntype of *Rhipidura picata* Gould, 1848, but there do not seem to be any other extant types.

[50] Notes now in CUL (Gould Collection Box 5b).

[51] *Ornithological Notes* vol. 1:259, QML.

[52] Gilbert's Port Essington types of *Tropidorhynchus sordidus* Gould, 1848 are several; those presently known are LIVM D.952s (M, collected at Victoria on 1 August 1849), D.891s (F, collected on 12 December 1840), ANSP 18489 (M), ANSP 18490 (M, immature), ANSP 18491 (F), MNHN VC 1873 nos. 369 (M), 370 (M, immature) & 371 (F,

immature) and there is also a syntype in Turin Museum (TMI, a female collected by Gilbert at Port Essington on 19 September 1840).

[53] The types of *Myzomela obscura* Gould, 1843 are ANSP 18227 (M), ANSP 18228 (F, which was missing for many years but has now re-surfaced) and CUMZ 27/MEL/24/R/1. The latter specimen was collected by John Gilbert in the "interior, Port Essington" on 8 August 1840. It is from the collection of Sir William Jardine (Jardine Catalogue 1874: No. 4729) but was originally received from John Gould, then purchased by Alfred Newton at the auction of the Jardine Collection in 1886. It was designated a "Syntype" of *Myzomela obscura* Gould, 1842 by Benson (1999:142).

[54] Gilbert's types of *Poephila personata* Gould, 1842 are ANSP 14625 (M), ANSP 14624 (F) and LIVM D.1761, a specimen obtained by Gilbert "in the interior" of Port Essington on 10 August 1840. A specimen now in Leiden (RMNH Old Catalogue No. 1) may also have type status. Gould remarked in *The Birds of Australia* (1848, vol. 3, text to plate 91) that " . . . several specimens were shot by Mr. Gilbert during an excursion from Port Essington towards the interior of the country." He goes on to quote Gilbert's notes on "Amadina — (58)" (CUL Gould Collection Box 1a), which recorded that the Masked Finch proved to be an inhabitant of grassy meadows near streams, and fed on grass seeds.

[55] Gilbert's notes on the Bar-breasted Honeyeater are now in CUL (Gould Collection Box 2a, under "Meliphaga — (21), Chalcites like"). The types of *Glyciphila fasciata* Gould, 1843 probably include LIVM T.13274 (M, collected by John Gilbert at "Mortunna" on 17 August 1840, a specimen from the collection of Canon H. B. Tristram) and ANSP 18360 (M), and possibly include LIVM D.5477s (M, collected by Gilbert on 27 January 1841), NHM 1850.11.21.2 (unsexed, probably M) and four other specimens which are now in Leiden and Paris. There is also a clutch of Bar-breasted Honeyeater eggs from Port Essington in the NHM (1960.1.259) which was probably also collected by Gilbert.

[56] Note that the similarity between the names of the localities Van Diemens Gulf (= south side of the Cobourg Peninsula) and Van Diemen's Land (= Tasmania) have caused problems with some of Gould and Gilbert's material, due to the mis-interpretation of these localities. For example, two Tawny Grassbirds (*Megalurus timoriensis oweni*), ANSP 16877 (M) & 16878 (F), which were both registered by curators at the Academy as having been collected in "Van Diemen's Land" (where the bird does not exist) and were thus puzzled over for many years, were actually collected by John Gilbert in Van Diemens Gulf.

[57] Gilbert's first specimen of the Rufous-banded Honeyeater was collected on Mayday Island on 28 August 1840 (LIVM D.5457s), and there are two other type specimens from "Van Diemens Gulf" (ANSP 18369 and 18591), but he collected more specimens later from a large inland mangrove swamp near Point Smith, the eastern headland of Port Essington. This may be the origin of NHM 1858.12.2.18, the skin of an adult bird, and an egg (NHM 1962.1.280) collected on "5th Dec," both labelled

"Port Essington." On 5 December 1840 Gilbert was indeed at Point Smith.

[58] Gilbert's type specimens of *Zosterops luteus* Gould, 1843 are now in ANSP: 18264 (M) and 18265 (F). They are the only specimens from the vicinity of the Cobourg Peninsula that have been located so far, but as the Yellow White-eye is a bird of tropical mangroves it is a very difficult bird to see, and even more difficult to collect. It is thus even more laudable that Gilbert managed to collect at least two of these little birds.

[59] Bynoe's bird is probably ANSP 14635 (not 14645, as in Stone 1913), an adult male with a black head. This was designated the "Type" of *Amadina gouldiae* Gould, 1844 by Stone *in* Stone & Mathews (1913: 178, = lectotype), but Gilbert's immature specimens of the Gouldian Finch from Greenhill Island or the more general locality Van Diemens Gulf must also be considered as being from the original type series. Those so far located are LIVM D.1773, an immature female collected on Greenhill Island by Gilbert on 30 August 1840, and ANSP 14637 & 14638 (both immature females with no apparent head colour), collected [by John Gilbert] in Van Diemens Gulf.

[60] Either those in the Gould Collection at CUL (Gould Collection Box 1b), or in Gilbert's *Ornithological Notes*, which is now in QML.

[61] Two *Haematopus longirostris* chicks were collected by Gilbert on 5 September 1840 at "Port Essington" (LIVM D.5012s & D.5086).

[62] Letter from Gilbert in Port Essington to Gould in London (MLS CY 461: 712-715, also see Chisholm 1938:195-197; 1940:167, Moyal 1976:66-67 and endnote 48). To confirm that Gilbert was indeed back at the settlement of Victoria on 19 September, the date on his letter, this is also the date and locality on Gilbert's original label attached to a male Green-backed Gerygone (*Gerygone chloronotus* Gould) (LIVM D.5490s), another new species Gilbert discovered during his stay at Port Essington. The types are the Liverpool bird and two at ANSP (777 & 778, male and female).

[63] However Gilbert discovered at least seven new mammals at Port Essington. The Northern Brown Bandicoot (*Isoodon macrourus*), Sugar Glider (*Petaurus breviceps ariel*), Antilopine Wallaroo (*Macropus antilopinus*), Brush-tailed Rabbit-Rat (*Conilurus penicillatus*) and the Delicate Mouse (*Pseudomys delicatulus*) were later named by John Gould. The Little Broad-nosed Bat (*Scotorepens greyii*) and the Black-footed Tree-rat (*Mesembriomys gouldii*) were described by John Gray, of the British Museum. All these names were based on Gilbert specimens from Port Essington and in all cases the type specimens are now in the NHM.

[64] Gilbert also wrote a detailed manuscript entitled "Birds of Copang," which is now in the General Library of the Natural History Museum. Oddly, apart from a single Brown Honeyeater now in ANSP, I have yet to find any of Gilbert's specimens from Timor in any other museum apart from National Museums Liverpool. Those in NML include speci-

mens of *Nectarinia solaris* (collected 30 September), *Poephila guttata* (30 September and 1 October), *Zoothera peronii*, *Sphecotheres viridis* and *Artamus cinereus* (all 1 October) *Meliphaga reticulata* (2 and 7 October), *Padda fuscata* (2 October), *Saxicola caprata pyrrhonota* (3 and 5 October), *Philemon buceroides* (3 and 9 October), *Lalage sueurii* (5 October) and *Gerygone inornata* (6 and 9 October). There is a Brown Booby (*Sula leucogaster)* in the Museum of Victoria (NMV B17578) which Gilbert collected off Melville Island on 29 October 1840, on the return journey from Timor to Port Essington.

[65] Localities include Point Smith, Coral Bay, Victoria, Table Head River (= Caiman Creek), East Bay and Knocker's Bay. All are recorded on specimens now in National Museums Liverpool.

[66] The types of *Ardetta stagnatilis* Gould, 1848 are ANSP 6566 & 6567 (both males) and those of *Dendrocygna australis* Reichenbach, 1850 (which was based on Gould's plate in *The Birds of Australia*) are ANSP 5957 (male) & 5959 (female).

[67] See Gould's *The Birds of Australia* 1848, vol. 5, text to plate 60.

[68] The types of the Green Pygmy Goose *Nettapus pulchellus* are ANSP 5972 & 5973, both males, and possibly two females now in RMNH. Those of the Peaceful Dove *Geopelia placida* (treated as *striata* in some references) are ANSP 13437 (M) & LIVM D.4269s, an unsexed bird collected by John Gilbert at Victoria, Port Essington, on 8th February 1841. Those of the Little Shrike-thrush *Colluricincla megarhyncha parvula* are ANSP 368 (M) & NHM 1881.5.1.446 (an immature male collected—presumably by John Gilbert—at Port Essington on 25th January 1841) and possibly two specimens now in MNHN (Charles Bonaparte Collection 1858, nos. 671 & 672). Those of the White-gaped Honeyeater *Lichenostomus unicolor* are ANSP 18563 (M) & 18564 (F), LIVM D.918s (F, collected by Gilbert at Knocker's Bay on 9 February 1841), and possibly a Gould specimen now at RMNH.

[69] From Gilbert's notes on the, "Loon-byte ... (115)... Little Goose," now in CUL Gould Collection Box 4d.

[70] See Gould's text in *The Birds of Australia* 1840-1848, vol. 2, text to plate 78.

[71] NHM 1962.1.299.

[72] Gilbert's notes on the Orange-footed Scrubfowl encompass at least 10 manuscript sheets in the Gould Collection now in Cambridge University Library (some sheets appear to be missing) and 11 sides of his *Ornithological Notes* (vol. 2:456b-465, QML). The comment about his "want of Education" is in John Gilbert's letter to John Gould dated 9 October 1842, which was copied by the 13th Earl of Derby (Archives Department of National Museums, Liverpool, MM/8/K/3, p. 159).

[73] See endnote 62. Letter now in the Mitchell Library, Sydney; CY Reel 461:712-715. None of the types have information other than "Port Essington" attached (these are ANSP 12770 (M) & 12771 (F), and pos-

sibly RMNH Old Catalogue: "Megapodius Duperryi" No. 1. M, a mount) and sadly no extant specimens can be found of this favourite bird of Gilbert's which still have his original labels attached.

[74] The types of *Megapodius gilbertii*, described by Gray in *Proceedings of the Zoological Society of London* 1861:289, are NHM 1860.9.6.32, an adult (?female) collected at Menado, Celebes by A. R. Wallace and purchased from the auctioneer Stevens, and 1873.5.12.2193, an adult female also collected by Wallace at Menado but purchased directly from him (the latter is not in the type cabinets). *Megapodius gilbertii* was considered to be a subspecies of the Philippine Megapode (*Megapodius cumingii gilbertii*) by Jones et al. in 1995:165-174. They thought (as I do) that it was probably named after John Gilbert (see their page 19). Gray seems to have named many of the new species he described in this 1861 *P.Z.S.L.* paper after various ornithological luminaries, but did not actually state their names or why he was so honouring them.

[75] Comment by Gilbert in a letter to Gould dated 17 September 1841 and written when the *Thomas Harrison* was off Start Point (MLS CY 461: 718-719).

[76] This agreement is now in MLS (ML A172: 128-131 / CYReel 461:525-528), also see Chisholm 1938:198-199.

[77] Comment by Gilbert in a letter to Gould dated 5 February 1842 (MLS CY 461:727-727).

[78] See Chisholm 1940:163.

[79] Gilbert collected a Brush-tailed Bettong (*Bettongia penicillata)* on 7 August 1842 at the River Avon (LIVM D.230b) and a Southern Brown Bandicoot (*Isoodon obesulus*) in the Toodyay Valley on 9 August (LIVM D.262b).

[80] James Drummond published an article about this expedition to the Moore River in the Western Australian *Inquirer* for 21 September 1842 (also see Whittell 1942:229-231).

[81] The letter sent by Gilbert from Perth to Gould (No 6), started on 13 September 1842 and continued on 9 and 24 October, is known from a copy taken by the 13th Earl of Derby (LIVM Archives, Lord Derby's copybooks vol. 3:147-161, 215-234, transcription available) but extracts from Gilbert's letter were also used by Gould in the *Introduction* to *The Birds of Australia* (lxxv-lxxvii) and in his *Handbook* (1865, vol. 2:155-159).

[82] The Western Chestnut Mouse, *Pseudomys nanus.* Gilbert's type series from the Moore River and Victoria Plains includes NHM 1844.9.30.10 & 11, and LIVM D.404, which still has Gilbert's original collecting label and was obtained on 2 September 1842. Gilbert collected two more Chestnut Mice on the Victoria Plains (LIVM D.404a & D.405), but he thought they were from another species. Gilbert's specimens are important records, as—apart from a few bones found in caves—they constitute the entire evidence that *Pseudomys nanus* once inhabited this

area. The Western Chestnut Mouse is now restricted to northern Australia.

[83] NHM 1844.1.22.21. Another Numbat obtained by John Gilbert at Toodyay (LIVM D.44a) may have been collected at the same time. Gilbert wrote a long series of notes about "*these beautiful little animals*" in his letter to Gould of September-October 1842 (see endnote 81).

[84] See endnote 81.

[85] A letter by James Drummond, dated October 1842, about the Wongan Hills expedition was published in the *London Journal of Botany*, see Whittell 1942:232.

[86] At Northam Gilbert collected a pair of White-backed Swallows (*Cheramoeca leucosternus*) on 16 September (LIVM D.1612 & D.1612a) and a Grey-fronted Honeyeater (*Lichenostomus plumulus*) on the 18th (LIVM T.13303, from the collection of Canon H. B. Tristram).

[87] Western Grey Kangaroo, *Macropus fuliginosus:* the information about the "*Flying Doe*" of the Moore River on 24 September was written by Gilbert on the collecting label of an animal now in the NHM (1844.2.15.6). He collected another Western Grey Kangaroo at "Sand Plains near Wongan Hills" on the 28th; it was a female with a pouch young (NHM 1844.2.15.5 & 7). On 29 September they actually arrived at the Wongan Hills (data on a male Tawny Frogmouth (*Podargus strigoides*) LIVM D.1603). Gilbert's description of their difficulties in reaching the Wongan Hills was included in his letter of 13 September-24 October (see endnote 81).

[88] The lectotype of *Mus albocinereus* Gould, 1845 is NHM 1844.7.9.16, from "scrub [by? on?] plains near Perth," collected by Gilbert on 15 October 1842. The NHM holds other Gilbert specimens of the Ash-grey Mouse, including an individual collected on the Victoria Plains (1844.2.15.28).

[89] This male Rufous Treecreeper, now in the H. L. White Collection (No. 7474) in Museum Victoria, Melbourne, was collected in Perth by Gilbert on 22 October 1842 (see Campbell 1923:1 and Whittell 1942:232). The specimen arrived in Melbourne in 1923 after being in private hands in England and then the USA, and at one time had been in the Museum of Comparative Zoology at Harvard University (MCZ 76440).

[90] An account of their journey to the south-west in 1842 was published by James Drummond in the *Inquirer* on 15 February 1843.

[91] Adam Armstrong had arrived in the new colony on the *Gilmore* in 1829 and was granted 1100 acres (445 ha) of the original Peel estate in the Ravenswood area. One of his six children was Francis Fraser Armstrong, who became an expert in Aboriginal languages and was made official Interpreter for the Swan River colony.

[92] Museum of Comparative Zoology No. 84611 / LN 2580.

[93] Gilbert must have collected at least seven Noisy Scrub-birds, as he mentioned four in his letter to Gould of 2 January 1843 (No 7), now in LCL (920 DER (13) 1/6/67/6, transcript published by Fisher, 1985), and he collected at least three more specimens at King George's Sound when he visited that area in May and June 1843. These are now in ANSP (17690 & 17691, male and female) and NHM (NHM 1880.12.31.68, a male). Two of Gilbert's four specimens from the Drakesbrook area are unaccounted for, and might (if they were the two he nearly blew to pieces) have been discarded.

[94] The female White-breasted Robin collected on the 4th is now in the NHM (1844.2.15.94), as is the male Gilbert collected on 25 November (1844.2.15.95).

[95] See Chisholm 1973:52.

[96] Comment in a letter from James Drummond to the botanist Sir Joseph Hooker (see Whittell 1942:239).

[97] NHM 1844.2.15.99 & 100. The island was St. Alouran Island according to Whittell (1949:50).

[98] Gilbert's comments about his new "Mutton-bird" are in his letter to Gould of 2 January 1843 (see endnote 93). The type of *Puffinus carneipes* is ANSP 5177, a female. Gould's plate for the "Fleshy-footed Petrel" in *The Birds of Australia* (1840-1848, vol. 7, plate 57) shows just one adult bird, but in the text he recorded that Gilbert had collected specimens and eggs [i.e., both plural] of this species off Cape Leeuwin. However, there seems to be no further Gilbert material (either skins or eggs) of the Flesh-footed Shearwater at ANSP, LIVM or NHM.

[99] Gilbert's observations on this "beautiful small species of Petrel" were also included in his letter of 2 January 1843 (see endnote 93). Two female White-faced Storm-Petrels collected by Gilbert on an "Island off Cape Leeuwen" are now in the NHM (1844.2.15.108, a female collected on 6 December 1842 and 1844.2.15.109, a male which has a very scrunched-up original label and had been wrongly labelled as having been collected on Wallaby Island, Houtman's Abrolhos). According to Salvin (1896:363, u, v & w) a pullet also collected by Gilbert at Cape Lewin was once in the NMH collections, but this cannot now be found.

[100] An immature male Black Bittern (*Ixobrychus flavicollis*) was collected by Gilbert at the Harvey River, which runs east from Myalup, just north of Australind, on 27 December 1842 (LIVM D.2825). Two birds now in the NHM which bear Gilbert's labels with the locality "near Australind" were collected on 27 and 28 December (an Elegant Parrot NHM 1844.9.15.98 and a Brush Bronzewing NHM 1844.2.15.101).

[101] In 1629 the Dutch ship *Batavia* stuck fast on a reef on the Houtman's Abrolhos. The captain, Pelsaert, left in a small boat to find water on the mainland and returned to find a band of his men had mutinied, divided up the cargo of the *Batavia* and the surviving women among them, and killed several of the ship's crew who would not join them. The mutineers were captured and most were hung.

[102] Details given in the *Inquirer* on 17 April 1843.

[103] Letter "No 9," dated 27 March 1843, extracts from which were read by Gould at a meeting of the Zoological Society of London (published 1844:33-37) and used in his *Handbook*, but which otherwise is only known only from a copy by the 13th Earl of Derby, now in the Archives Department of National Museums Liverpool, which was published by Wagstaffe and Rutherford in 1955.

[104] An Australian Sea-lion (*Neophoca cinerea*), collected by Gilbert on the Houtman's Abrolhos, is now in the NHM (NHM 1844.2.15.42) and there is part of a skull from this species of sea-lion in LIVM which was almost certainly collected by Gilbert in 1843 (LIVM D.130, collected on "Mangrove Islands, Houtman's Abrolhos").

[105] Gilbert's comments about a form of "Sericornis? Is this not a new Species?" which he found on the Houtman's Abrolhos are also in his letter "No 9," as are his other comments on the birds inhabiting these islands (see endnote 103). He only found these Scrubwrens on two of the islands (East and West Wallaby Islands). Only two of Gilbert's Houtman's Abrolhos specimens of *Sericornis frontalis balstoni* have been located so far (ANSP 17634, male & 17643, female).

[106] Gould's type description of *Hemipodius scintillans* was published in 1845 (*Proceedings of the Zoological Society of London*: 62). One of the types of *Turnix varia scintillans*, collected on West Wallaby Island by Gilbert on 23 January 1843, is now in LIVM (D.3695). Two others are in Philadelphia (ANSP 12437, male & 12438, female).

[107] Gilbert's "Redbilled Tern," the Australian Roseate Tern, was described as *Sterna gracilis* by Gould in 1845 (*Proceedings of the Zoological Society of London*: 76). The types are probably two birds now in Philadelphia (ANSP 4924, male and 4925, female, both labelled "Houtman's Abrolhos") but two other Roseate Terns collected by Gilbert on the Houtman's Abrolhos Islands are now in LIVM (D.3371, a male from South Island collected on 9 January 1843) and NHM (1844.2.15.116, an immature with no date, but also from South Island).

[108] *The Birds of Australia* 1840-1848, vol. 7, text to plate 27.

[109] Types of *Onychoprion fuliginosus* Gould, 1848 (described in The birds of Australia 1840-1848, vol. 7, text and plate 32) are in Philadelphia (ANSP 49655, 4967, 4968, and 4969, which include adults, immature and downy young). At least five Sooty Terns, including immatures and pullets (some of which were probably of type status), collected by Gilbert on the Houtman's Abrolhos in January and February 1843, were once in the NHM (Saunders and Salvin 1896:110) but these appear to now be missing.

[110] For instance, Gilbert collected at least two Common Noddies on South Island on 3 February 1843 (LIVM D.3407, female & D.3407b, male).

[111] Probably King's Skink (*Egernia kingii*) according to leading Australian herpetologist Harold Cogger (formerly of the Australian Museum) and

Andrew Burbidge of Conservation and Land Management, Western Australia. Burbidge remarks that the only other large reptile inhabiting the Houtman's Abrolhos is the Gidgee Skink (*Egernia stokesii*).

[112] The types of *Anous melanops* Gould from the Houtman's Abrolhos (described in 1846 in *Proceedings of the Zoological Society of London*: 103) are ANSP 1757 (male) and 1758 (female); LIVM D.3409a (male, mounted specimen) & D.3409b (female, cabinet skin), collected by Gilbert on South Island on 9 and 10 February 1843; NHM 1894.10.28, an adult, now missing, collected on the Houtman's Abrolhos on 29 January 1843; MCZ Harvard 83921, a male which was discarded, but with Gilbert's original label still extant in a scrapbook, collected on South Island on 10 February 1843.

[113] NHM 1844.2.15.114 is an immature Wedge-tailed Shearwater collected by Gilbert on South Island, 20 January 1843.

[114] Quote from Gilbert's article in the *Inquirer*, dated 17 April [1843].

[115] Gilbert's specimens of White-faced Storm-Petrel include NHM 1844.2.15.109, adult, from Wallaby Island [collected in 1843]; 1844.2.15.110, immature, Houtman's Abrolhos; 1888.5.18.28, immature, "Islet south of Wallaby Island," collected on 18 January 1843. The latter specimen was passed from John Gould to Thomas Eyton's collection, then to the Osbert Salvin Museum, then to F. D. Godman and lastly to the NHM.

[116] According to a letter dated 20 March by Daniel Scott, the Harbourmaster who had arranged Gilbert's passage to the Houtman's Abrolhos, they had arrived back on "*Friday last*," which would have been 17 March (Whittell 1942:295).

[117] This letter of 18 April 1843, No. 10, is now in Liverpool City Libraries (920 DER (13) 1/67/7). A transcript has been published (Fisher 1985:9-11)

[118] Gilbert's type of *Chaeropus occidentalis* Gould, 1845 (= *Chaeropus ecaudatus* Ogilby, 1838) is NHM 1844.7.9.22, a female from "Walyemara district about 45 miles NE of Northam," the same data as the Pig-footed Bandicoot which Gilbert wrote about at length in his letter of 18 April 1843 (see endnote 117).

[119] Gilbert's letter to Gould of 15 December 1843 included the information that H.M.S. *North Star* had arrived at King George's Sound while Gilbert was there. According to the *Perth Gazette*, the *North Star* arrived at Albany on 26 May and left on 2 June 1843. This letter was Gilbert's No. 13, which he misdated as December 1842 (MLS CY 461: 720-723, also see Chisholm 1940:168).

[120] These specimens were a Noisy Scrub-bird NHM 1880.12.31.68 (an adult male collected on 4 June 1843) and a Western Bristlebird NHM 1881.2.18.151 (a female, collected on 10 June). Both these were received by the NMH from the Museum of Thomas Campbell Eyton. The Gilbert's Potoroo, an immature female, is now in Liverpool (LIVM

D.232b, collected by Gilbert in the "vicinity of Albany" on 15 June 1843).

[121] This Dibbler is now in Liverpool (LIVM D.272a). The lectotype of *Notomys longicaudatus* (Gould, 1844) is NHM 1844.7.9.15, from the Moore River, but this specimen has no date. Gilbert had already collected a Long-tailed Hopping-Mouse at Victoria Plains (on the Moore River) on his first visit there in August 1842, and there are two specimens now in Liverpool which Gilbert collected in 1843; the one mentioned in the main text, collected at the Moore River on 7 July, and another obtained near Toodyay on 19 September 1843. It should also be noted that during this period Gilbert also collected at least one, and probably both, of the only two specimens known of the Big-eared Hopping-mouse (*Notomys macrotis* Thomas, 1921). Gilbert certainly collected the holotype (NHM 1844.7.9.14, which he obtained at the "Moores River" on 19 July 1843) and probably also collected the other specimen, a skin and skull marked only "Australia" but also received by the NHM from Gould (1841.1167). This specimen is much darker above than the holotype. According to Oldfield Thomas, the scientific name "*macrotis*" had been mentioned by both Edward Gerrard and John Gould, but they had never formally published it.

[122] LIVM D.1641, a male collected "4 miles east of York" on 19 August 1843. This is one of the paralectotypes of *Pachycephala Gilbertii* Gould, 1844, along with ANSP 15257, a female from "Western Australia." The lectotype is ANSP 15256, a male also from "Western Australia." Gilbert also collected an immature male Gilbert's Whistler near Botherling on 29 October 1843 (LIVM D.1641a). A specimen of "Pachycephala gilbertii" was included on Gould's list of objects sent to Temminck in Leiden in 1850 but this specimen cannot now be found.

[123] Archibald Campbell gave this information in the *Introduction* to his *Nests and Eggs of Australian birds* 1901:xi.

[124] LIVM D.783b, a male.

[125] Gilbert's movements can be inferred from his field labels on skins of Long-tailed Hopping-mouse LIVM D.412, collected at Toodyay on 18 September 1843; Southern Scrub-robin (*Drymodes brunneopygia*) NHM 1881.2.18.8, collected at Botherling on 19 October; Pied Honeyeater (*Certhionyx variegatus*) LIVM D.5310, collected in the "Vicinity of Botherling" on 20 October; Tammar Wallaby LIVM D.219a, collected in the "Vicinity of Wongan Hills" on 22 October; eggs of Blue-breasted Fairy-wren (*Malurus pulcherrimus*) NHM 1962.1.54, collected at the Wongan Hills on 27 October; skins of Masked Woodswallow (*Artamus personatus*) LIVM D.1624a, collected in the "Vicinity of Botherling" on 28 October; Black Honeyeater LIVM T.12765, collected in the "Vicinity of Wongan Hills" on 29 October; Western Barred Bandicoot (*Perameles bougainville*) LIVM D.261, collected in the "Vicinity of Wongan Hills" on 29 October; Gilbert's Whistler (*Pachycephala inornata gilbertii*) LIVM D. 1641a, collected in the "Vicinity of Botherling" on 29 October; Pied Honeyeater LIVM T.12770, collected in the Toodyay Valley on 12 November.

[126] See endnote 119 (Gilbert's letter No.13 is in MLS, see CY 461:720-723).

[127] The dates of departure and arrival of the two ships were ascertained by Chisholm (1940:163).

[128] Comment in a letter from Frederick Strange to John Gould, dated 22 February 1844 (NHM General Library, John Gould Collection Box 10). Frederick Strange, who was born in Norfolk, on the eastern coast of England, was not only semi-literate but notoriously unreliable. He later caused John Gould much trouble over specimens, which he used to set up bidding wars between rival purchasers. Strange was killed by Aborigines on the Second Percy Island in 1854.

[129] John MacGillivray, son of the famous Scottish ornithologist Professor William MacGillivray (who collaborated with John James Audubon on his *Ornithological Biography*), was an excellent collector who published important material on the Australian fauna, having acted as naturalist both on H.M.S. *Fly* and subsequently H.M.S. *Rattlesnake*. Among many new species, he collected the type specimens of the Red-legged Pademelon (*Thylogale stigmatica*) (at Point Cooper) and the Fawn-breasted Bowerbird (*Chlamydera cerviniventris*) (at Cape York). Like Strange, however, MacGillivray was a difficult character, spending time in gaol for debt and eventually dying of alcoholism in Sydney in 1867.

[130] In a letter to Gould dated 4 June 1844 (NHM Gould Collection), Strange wrote that "HM ship Fly have now been away about three months and Mr MacGillavaray is gone in her, he use to stope with me when he was in Sydney and Mr Gilbert have been gone about the same time Beyong [beyond] New England and I have not heard from him since he left ...."

[131] This diary, one of the manuscripts discovered by Alex Chisholm in private hands in England in 1938, is now in the Mitchell Library in Sydney. It is in two parts, the leather-bound, hard-backed volume and another section constructed from loose pages stitched together. The first part was misfiled for almost 20 years but has now been located and returned to the correct box. Sydney-based ornithologist Ian McAllan, most remarkably, managed to read much of Gilbert's pencilled writing in the first volume from a microfilm the Mitchell Library made over twenty years ago, although the marks of Gilbert's pencil are now very faint and are often totally erased (see McAllan 1994). Since the first volume of the diary was found again, Ian and I have tried to add to the transcription, but we eventually came to the conclusion the microfilm was actually easier to read than the original, because of the ability to change the light direction on the film from the back.

[132] The Coxen brothers had come to farm in Australia in about 1833, and incidentally had acted as collectors for the Zoological Society of London and for their brother-in-law, John Gould, since their arrival. They had settled on a station at Yarrundi but Charles Coxen (1809-1876) had also taken up a station on the Darling Downs in 1840. Charles Coxen later became a member of the first Queensland

Parliament and a Crown Lands Commissioner. He is credited with discovering several new Australian birds, including the White-backed Swallow (*Cheramoeca leucasternus*), described by John Gould from material Charles Coxen collected on the Namoi River. Charles' much older brother Stephen (1788 -1844) did not fare so well, dying by his own hand a few months after Gilbert's visit to Yarrundi.

[133] Charles and Stephen Coxen signed insolvency papers in Sydney on 26 April 1844, according to the *Sydney Morning Herald* for that date (vol. XVII, No. 2, 168:[3]).

[134] H. M. Challinor (1919) included information in his article about a huge droving operation, when H. W. Coxen undertook the overlanding of 3000 sheep from Homebush (Sydney) to the Darling Downs, which may have referred to the stock movement which Gilbert joined.

[135] The Plague Locust (*Chortoicetes terminifera*).

[136] As yet, no skins, eggs or nests of the Flock Bronzewing from this period of Gilbert's travels, or skin of the Letter-winged Kite, have been located. Their "Peristera Creek" was probably the present day Ten-mile Creek.

[137] Waterloo Creek had been the site of the slaughter of 300 Aborigines in January 1838, prior to the more well-known Myall Creek Massacres in June of that year. In 1992 the journalist Roger Milliss published a book on Aboriginal genocide called *Waterloo Creek.*

[138] Gilbert later collected two of these woodswallows, on which Gould based his description of *Artamus albiventris* in 1847. In this original description Gould specified that Gilbert had collected one of these two specimens, "on the Darling Downs, in New South Wales" and the other at Peak Range Camp (a campsite on the Leichhardt Expedition). Gould's name was considered too close to *Ocypterus albiventris* Lesson, and in 1890 Richard Bowdler Sharpe renamed this bird *Artamus hypoleucus.* Sharpe's name is now considered a synonym of one of the subspecies of the Black-faced Woodswallow (*Artamus cinereus melanops*), which was named by Gould in 1865 (Schodde and Mason 1999). Gilbert's two specimens are both now at ANSP: 15493, a female with a missing tail marked "New South Wales" (which must be the Darling Downs specimen) and 15492, a male marked "Port Essington" [= Northern Territory] but actually from the Port Essington *Expedition* [= Leichhardt Expedition] and presumably Gilbert's specimen from Peak Range Camp, which would have been collected on 28 January 1845.

[139] Of the 12 type specimens of *Therapon unicolor* Gunther 1859, six were collected by Gilbert "in a Creek near Mr Halls station on the Big River" and six later at the "Head of Mosquito Creek, near Darling Downs." They are all now in the NHM.

[140] A naval term, meaning not very much at all.

[141] Various snippets in Gilbert's diary allude to the animals involved in the droving operation: his entry for 20 April gives us the information that they were "Stationary all day to rest the Cattle." On the 23 April his diary reads: " . . . down . . . to Cox's Station, here we have to wait for a party following us with Sheep and a cart with Provisions so that we can travel farther."

[142] In the entry for *Antechinus murinus* in Gould's *The Mammals of Australia* (1845-1863, vol. 1, text to plate 43), he wrote that Gilbert had caught individuals of this little carnivorous marsupial on the banks of the Severn River [= Dumaresq]. Gilbert had told him that the male was larger than the female and had a darker mark round the eye. Two Gilbert specimens from the "Severn" River are now in the collections of the NHM: NHM 1853.10.22.26 and 1853.10.22.27. The latter still bears its original Gilbert label. Gilbert collected more specimens of Common Dunnart (NHM 1853.10.22.23 and LIVM 1981.35) a little later that year, in the "Brushes of Darling Downs."

[143] See page 170 of Gilbert's diary (MLS). Gilbert has written "Circus. Killed on the Severn April 23rd 1844. Tool-lo-lee [the Aboriginal name]. Male." It was probably also in the vicinity of the modern town of Texas that Gilbert collected some hybrids between the Pale-headed and Eastern forms of the Eastern (White-cheeked) Rosella (*Platycerus eximus*), as this is the centre of the hybrid zone in modern times (Ian McAllan, pers. comm.). Gilbert's specimens, an immature and at least one adult, were later used as the basis for John Gould's description of *Platycercus splendidus* (*Proceedings of the Zoological Society of London* 1846:105. Gould, however, recorded these specimens as having been collected on the Darling Downs). Gilbert's specimens were probably the two which were included in the Gould Collection when it was purchased by the Academy of Natural Sciences in Philadelphia, but the adult male (Verreaux number 307) is missing and indeed was never accessioned. The immature male is still in the collections there (ANSP 22872 / VN 306, from "New South Wales") and closely matches the young bird—the higher—in Gould's plate for *Platycercus splendidus* in *The Birds of Australia* (1848, vol. 5, plate 28).

[144] See Gilbert's list on page 169 of his diary (MLS).

[145] This letter, which Gilbert wrote to Gould from the Darling Downs on 8 June 1844, is only known from a copy made by the 13th Earl of Derby, now in Liverpool City Libraries, U.K. (920 DER (13) 1/67/6).

[146] Paradise Parrot specimen LIVM D.789a. Gilbert original label reads: "Male. May 17 1844. Condamine River, Darling Downs," on the reverse, "Irides Dark Brown." This immaculate adult male specimen (which is now so festooned with labels that it has been given a supporting wooden rod for their attachment, to save pulling the legs off) was discussed in Fisher 1985 and 1986.

[147] The Paradise Parrot specimen now at Harvard is numbered MCZ 74281. Gilbert's original label (which has been removed from the specimen and pasted in a scrapbook) reads: "Young male. July 10. 1844. Darling

Downs. New South Wales." The second Paradise Parrot specimen in National Museums Liverpool is LIVM D.789b. Gilbert's original label reads: "Young male. July 13 1844. Oakey Creek, Darling Downs New South Wales," on the reverse "Irides Reddish brown." Charles Coxen's station at Jondaryan was on Oakey Creek, the watercourse where this specimen was collected; Gilbert seems to have based himself in this area of the Darling Downs for several months. Four of the Gould Collection Paradise Parrots now in Philadelphia were also probably collected by Gilbert on the Downs during this period, although their original labels are missing: ANSP 22912 (adult male), 22913 & 22914 (young females) and 22915 (adult male, designated the lectotype of *Platycercus pulcherrimus* Gould, 1845 by Witmer Stone in 1913).

[148] Letter from Frederick Strange to John Gould, postmarked Sydney, 20 July 1844 (Gould Collection Box 10, General Library, the Natural History Museum, London).

[149] A letter to John Gould dated 1 October 1844, sent by Charles Coxen from Yarrundi, where he had returned in order to clear up his deceased brother's affairs, includes the remark: "Gilbert is with me (or was when I left) at my Moreton Bay Station … [he] is expected to be in Sydney in a few weeks" (NHM, Gould Correspondence). Coxen was obviously unaware that Gilbert had joined the Leichhardt Expedition.

[150] This "Wallaby killed at Pearces," which Gilbert said had a white stripe on the cheek, was probably the Bridled Nailtail Wallaby (*Onychogalea fraenata*). Two Gilbert specimens of this extremely rare macropod (which is now confined to a few properties in the Dingo district in the the Dawson Valley in Queensland) are in the collections of the Natural History Museum in London: NHM 1853.10.22.28, a one-year old male and 1853.10.22.29, a mature female. Gilbert has written a date (19 August 1844) only on the label attached to the female, but his labels on both specimens give the locality "Brushes of Oakey Creek, Darling Downs." Bruce Lawrie comments that Helidon is actually in the Lockyer Valley, in the Brisbane River Catchment, whereas Oakey Creek is in the Condamine Catchment, west of the Toowoomba Range. He thinks it more likely that Gilbert would have found the Bridled Nailtail Wallaby in the softwood scrub of Oakey Creek rather than the more forested area around Helidon, a theory endorsed by the labels on the two NHM specimens. Perhaps Gilbert meant "Wallaby killed **while I was staying** at Pearces."

[151] Letter by John Gilbert from the Darling Downs, dated 10 September 1844, to George Bennett in Sydney (Leichhardt Papers c.161, Mitchell Library, Sydney).

[152] The lectotype of *Podabrus macrourus* Gould, 1845 is LIVM D.275, a skin and skull of a male (from open plains, Darling Downs). Gilbert collected at least two more specimens on the Darling Downs, one of which was formerly also in Lord Derby's Collection at LIVM, but is now in the NHM (1887.5.4.1, skull of female). The new rodents, described by John Gould in 1845 and 1858, were the Eastern Chestnut Mouse

(*Pseudomys gracilicaudatus*) (from Oakey Creek, Darling Downs); a form of the Plains Rat (*Pseudomys australis lineolatus*) (from open plains, Darling Downs), and the Canefield Rat (*Rattus sordidus*) (from open plains, Darling Downs). One of the three types of the Canefield Rat bears the date "July" [1844]; these three specimens are the only records of this species from southern Queensland. The types of these four new mammals of Gilbert's are divided between the NHM in London and National Museums Liverpool.

[153] The holotype and unique specimen of *Notomys mordax* Thomas, 1922 is in the Natural History Museum in London (skull NHM 1846.4.4.65, labelled only "Darling Downs").

[154] Letter from Gilbert on the Darling Downs to Bennett in Sydney, dated 10 September 1844; see endnote 151.

[155] Also in Gilbert's letter to Bennett, dated 10 September, is the remark "I have only had nine days to prepare," which would mean that Leichhardt agreed for him to join the Port Essington Expedition on or about 1 September. They must have met at least a few days before that.

[156] There is a perhaps ironic remark in Gilbert's letter to George Bennett about his expenditure on horses and equipment for the expedition, which came to less than £60, which Gilbert pointed out was less than a ticket for a ship's passage to Port Essington would have cost. This was no doubt a reference to John Gould's notorious firmness of hold on his purse strings. As for the horses, a snippet in Gilbert's diary, written much later (frame 967a on the MLS microfiche), gives us a glimpse of the equipment a bird collector's horse carried. The offside bag no. 4 on "Blackbird" contained "Horse Shoes, Alum, Second Red Shirt & Boots & Socks and Johns [Murphy] Guernsey." "Jemmy" carried "Large shot in Kangaroo skin" as well as "Arsenic with powder in Trousers." Gilbert's own horse was called Bobby (see frame 974a on the MLS microfiche).

[157] Gilbert sent this parcel, along with a short letter, to Frederick Strange in Sydney on 16 September, asking him to take a small packet of seeds out for Mrs. Bennett and then to re-seal the box and send it on to Gould. He also told Strange to look at the specimens before he sent the box on to Gould; Gilbert was obviously proud of his new parrot. This was the last letter written by John Gilbert that has been located (it is now in the Lionel Lindsay Gallery & Library, Toowoomba), although he must have sent others back with Hodgson when the latter left the expedition.

[158] "Jimbour" was rebuilt in magnificent style by Thomas Bell's sons between 1874 and 1876. The Russell family bought the house in the 1920s and made extensive renovations, and have now opened the grounds to the public.

[159] In the pencilled part of Gilbert's diary (MLS microfilm, frame 928b) is a list of "specimens obtained during the Port Essington Expedition." Unfortunately this is almost unreadable, but there is a list of eggs which can be partially read and the rest of which can be reconstructed from

comments made later on in Gilbert's diary, and from blown eggs now in the collections of the NHM at Tring. These eggs have been carefully labelled in ink by Gilbert. Although he recorded several eggs in each clutch, in most cases only one egg is extant—perhaps he only kept one to save space, or the others were discarded by Leichhardt when he abandoned all Gilbert's rock samples and the zoological duplicates in early October 1845. The surviving eggs which have so far been found are: Whistling Kite (*Haliastur sphenurus*) NHM 1955.5.78, labelled "Vicinity of Jimba. Oct. 2. 1844"; White-necked Heron NHM 1962.1.94, labelled "Vicinity of Jimba. Oct.2. 1844"; Australasian Grebe NHM 1962.1.45, dated "Oct 6. 1844" and an egg of the Painted Button-quail NHM 1962.1.202, dated "Oct. 6 1844." Pemberton Hodgson left the expedition on 4 November 1844, so it is possible these eggs were sent back with him, and that Gilbert gave up collecting eggs after that.

[160] LIVM D.1977a, a male. They were about 30 miles (48 km) west of Jimbour on this date, just east of the Condamine River, resting and mending pack saddles.

[161] Leichhardt later named this "Flourspill Scrub" (Leichhardt 1847:17).

[162] During 1977-1978, Bruce Lawrie of Queensland Parks and Wildlife Service re-surveyed all five sites on the Leichhardt Expedition for which Gilbert had made substantial bird lists in his diary: Kent's Lagoon (10-21 October 1844), Erythrina Creek (11 December 1844), Suttor Creek (8 March 1845), Fretted Sandstone Camp (16 April 1845) and Whitsunday Lagoons (12-15 May 1845). Bruce Lawrie's lists are being edited for publication, but in the meantime my references to bird species seen by Gilbert have all been checked against Bruce's diagnoses to make sure they correspond. We agree in almost all cases. Bird species which Gilbert listed at Kent's Lagoon and which Bruce Lawrie considers of particular importance were Black-throated Finch (*Poephila c. cincta*) (classed as vulnerable, and no longer present in the Chinchilla District); Glossy Black-cockatoo (*Calyptorhynchus lathami*) (classed as vulnerable); Squatter Pigeon (*Geophaps scripta scripta*) (the southern subspecies, which was recorded at all five sites by Gilbert but only at Suttor Creek by Lawrie) and Bush Stone-curlew (*Burhinus grallarius*), which is classed as declining due to habitat destruction and degradation from urban development, intense cultivation (replacement of native grass with improved pasture), burning and overgrazing. The Bush Stone-curlew appears vulnerable to impact by feral predators, especially foxes and cats, but the evidence is conflicting (Lawrie, pers. comm.). Gilbert's records of Brush Turkey (*Alectura lathami*) and Wonga Pigeon are also interesting.

[163] Of the birds which Gilbert recorded as having collected at Kent's Lagoon, the Yellow-faced Honeyeater is now in the collections at LIVM (D.1036s, a female collected on 15 October) but there is at present no sign of the "*Acanthiza*." This, from Gilbert's comment that the eyes were "greenish white," was probably a Buff-rumped Thornbill (*Acanthiza reguloides*).

[164] The White-throated Nightjar has not yet been found, but the "*Ptilotis*" must have been a male Fuscous Honeyeater which is now in LIVM (D.1019s). Gilbert has actually recorded "22 October" on the label. As for the "*Mus*," none of the mammal specimens from the Leichhardt Expedition which survive is attributable to Gilbert, but this may be because Leichhardt claimed all specimens except for birds (see Gilbert's diary entry for 31 December 1844, where he said that he had handed all his own mammal specimens over to Leichhardt).

[165] From William Phillips' diary of the Leichhardt Expedition, Mitchell Library Sydney C 165, pp. 6-7. However, it was Pemberton Hodgson who later rode north to try to find out what had happened to the expedition; he got as far as the Robinson Gorge.

[166] They had entered the catchment area of the river they would later name the Dawson, travelling down Roche Creek and then moving over the still very beautiful Dawson Valley. According to Chisholm (1973) and Leichhardt (1847), Robert Dawson was a Yorkshireman who had come to New South Wales in 1825 as the first manager of the Australian Agricultural Company, and had taken up "Black Creek" on the Hunter River. The choice of name for the Dawson River was made because Dawson had donated a bullock to the expedition; one might say that he got rather a good return. The conical hill the expedition members climbed could not be found for many years until, very recently, the timber in the area was felled and the hill magically re-appeared again from under the trees. It is about 22 miles (35 km) east of the modern town of Wandoan, and is now being made more accessible for visitors as part of the Leichhardt trail.

[167] This clutch of 2 Squatter Pigeon eggs is now in the NHM (NHM 1865.2.3.59) and both eggs are clearly labelled by Gilbert as having been collected on 6 November 1844, although the only eggs of this species which Gilbert mentioned in his diary were under his entry for **2nd** November.

[168] Later named Roche Creek.

[169] This remark by Charley was quoted by Leichhardt (1847).

[170] Gilbert's discovery of a Star Finch's nest on Juandah Creek emphasises the serious decline of this little grass finch, once known in swampy areas throughout coastal New South Wales and Queensland, but which is now confined to parts of the north and north-west coast and eastern Cape York (Schodde and Tidemann 1993).

[171] The memorial was erected by the Wildlife Preservation Society of Queensland and the Taroom Lions Club in 2004 as part of the celebrations for the Leichhardt Expedition Exposition. One text panel carries this quote of Gilbert's, and another gives a resumé of Gilbert's life. In the centre is a plain stone cairn, with a dedication plaque and a helpful directional marker showing reference points, such as those concerning Leichhardt's expeditions, in relation to the stunning view in front of the reader. The central point of the town of Taroom is the now-enormous

Coolibah tree which the Leichhardt Expedition blazed with the letters "LL" as they passed, and which is now festooned with commemorative plaques.

[172] The Crimson Finch had in fact been already discovered at Raffles Bay by Hombron and Jacquinot before Gilbert's visit to Port Essington, they had given it the name *Fringilla phaeton* in 1841. Gilbert did not say whether he had actually collected any specimens of the Crimson Finch on the Robinson River; such material would now be of great interest.

[173] The only Plum-headed Finch from the expedition that has been found so far that could be the specimen Gilbert collected on the Robinson is a female from John Murphy's collection, which is now in the Royal Albert Memorial Museum in Exeter. It unfortunately has no date or locality.

[174] No Paradise Parrots collected during the Leichhardt Expedition have been located, so unfortunately Gilbert's "Port Essington Expedition" diary records cannot be authenticated.

[175] Male and female *Sericornis laevigaster*, ANSP 17632 & 17633, labelled "Interior of Australia." Gould knew that Gilbert had collected these two specimens while he was on the Leichhardt Expedition, but wrongly reported in his *Handbook* that "there is no information whatever respecting them in his Journal" (1865, vol. 1:360-361). Both Gilbert and Gould specified that Gilbert had only collected one specimen of each sex, but Meyer de Schauensee (1957:207) stated that there was an unsexed skin in the Gould Collection at the NHM, which must have been received by Gould after he published his *Handbook.* Meyer de Schauensee was probably referring to a Thomas Eyton specimen (NHM 1880.12.31.22), which has no data apart from "Australia." A DNA comparison with the two ANSP specimens might be useful.

[176] *Cinclosoma castaneothorax* was described by John Gould in 1848 from a specimen collected by his brother-in-law Charles Coxen on the Darling Downs.

[177] Zamia Creek was so named by Leichhardt after the huge cycad palms festooning the banks, but outback historian Glen McLaren (in his Curtin University thesis of the 1990s, which was based on the geographical data he acquired from retracing the entire route of the Leichhardt Expedition) thought this was the creek now marked on the modern maps as Comely Creek, and thus the modern placing of Zamia Creek (and Roper Pass) is wrong.

[178] From Gilbert and Leichhardt's description of the pelage of these kangaroos, and Gilbert's records of their weights, they were probably individuals of the Queensland subspecies of the Brush-tailed Rock-wallaby (*Petrogale penicillata herberti,* which is often known as Herbert's Rock-wallaby and should possibly be treated as a full species). They managed to kill just a few specimens. The area that the Leichhardt expedition members had reached is close to the present northern limit of dis-

tribution of this macropod, and it is quite likely that they were more widespread in the early nineteenth century.

[179] "Erythrina Creek" was one of the five sites re-visited by Bruce Lawrie in the late 1970s, in order to compare Gilbert's bird list with the modern fauna. He confirms that several of the species listed by Gilbert were at the edge of their modern range, such as the Red-browed Finch (*Neochmia temporalis*) (western extent) and Crested Bellbird (eastern extent). Other notable species listed by Gilbert were Black-throated Finch and Paradise Parrot, as well as the Turquoise Parrot, which now only occurs much further south. His possible sighting of Powerful Owl is also significant. Hooded Robins (*Melanodryas cucullata*) and the Diamond Firetail, birds of timber and woodland, are also now declining.

[180] The Red-backed Fairy-wren (*Malurus melanocephalus*) was one of the species Gilbert listed, and an egg of this species now in the collections of the NHM (NHM 1962.1.58), which bears the date 11 December 1844, was possibly collected by Gilbert at this locality. Six skins of birds collected by Gilbert at Erythrina Creek are now in the collections of National Museums Liverpool: White-plumed Honeyeater (*Lichenostomus penicillatus*), Yellow-faced Honeyeater, Figbird (*Sphecotheres viridis*), two Plum-headed Finches and, a first for the expedition, a Spangled Drongo.

[181] Their route was so arduous (being at times only 20 foot (6.1 m) wide and with steep and dangerous gullies on both sides) that Glen McLaren, following their footsteps 150 years later, gave up and crossed Expedition Range using the modern Dawson Highway.

[182] The dry river they had reached was an anabranch of the watercourse they later named the Comet. On 14 December Gilbert recorded that he had collected a "*Ptilotis Chrysotis* or a nearly allied species," although its, "quiet whistling call" seems ill-fitting for Lewin's Honeyeater (*Meliphaga lewinii*). However, it is possible that this specimen is a Lewin's Honeyeater now in ANSP (18515, a female), which is marked "Port Essington" (= north coast of Northern Territory). This locality cannot be correct; so the bird must have been collected on the "Port Essington **Expedition**." On 15 December, when they had almost reached the Comet River (Comet Creek), Gilbert recorded that he had collected a "*Ptilotis sonorous*" (= Singing Honeyeater *Lichenostomus virescens*). This may be a Singing Honeyeater now in the NHM (NHM 1881.5.1.5587, an immature male), but this bears the collecting date **20th** December. Singing Honeyeaters (note the plural) collected by Gilbert on "Dr Leichardts Expedition" were mentioned by John Gould in his *Handbook* (1865, vol. 1:504).

[183] In his thesis for Curtin University, Glen McLaren wrote that he thought this was the waterbody now called "Pink Lily Lagoon" and the name "Brown's Lagoon" has been erroneously applied to the wrong lake. It was while they were camped at this lagoon that Leichhardt told Gilbert he wanted him to have charge of the campsites if he himself was absent, in effect electing Gilbert as his deputy. It unfortunately meant that

Leichhardt and Gilbert could no longer go out scouting together. In contrast, it was at this time that Leichhardt and Gilbert began to have serious disagreements about ownership of specimens.

[184] From the date, the Singing Honeyeater mentioned in endnote 182 may have been collected at Brown's Lagoons. Gilbert also recorded that he had obtained Chestnut-breasted Mannikins (*Lonchura castaneothorax*) there; these are possibly represented by a female now in Philadelphia (ANSP 14560, from the "Interior of Australia") and two adult finches now in RAMM, Exeter (although these were prepared by Murphy, probably under supervision). While at Brown's Lagoon Gilbert also shot "Calamanthus minimus and the small species of Pomatorhinus." These were a Speckled Warbler, and one of the Babblers, possibly the Chestnut-crowned Babbler (*Pomatostomus ruficeps*) or the White-browed Babbler (*P. superciliosus*), according to Alec Chisholm (1945: 190); either would be an interesting record. However, it is worth noting that Bruce Lawrie recorded Grey-crowned Babblers (*Pomatostomus temporalis*) at all five of Gilbert's sites which he re-visited, although this is actually the *biggest* Australian babbler.

[185] The species represented amongst the Leichhardt Expedition specimens now at RAMME are almost exactly the same as those in a list of species written by Gilbert, but entered in John Murphy's expedition diary (also now in the Mitchell Library, Sydney). The specimens are not as good as Gilbert's, but he had taught Murphy very well considering the circumstances under which they were travelling. Murphy's Black-throated Finch is labelled as having been collected by "J. Strange" but this must be an error for the name of the dealer (?Frederick Strange) who returned the specimens to England. Murphy's collection was donated to RAMME by a "Miss Fox"; we do not know at the moment what connection she had with the expedition.

[186] Gilbert's diary entry for 24 December 1844.

[187] A comment made in Gilbert's diary for 18 June 1845 was that he had seen his "new Platycercus of the Downs, a species which had not been observed … since leaving Deception Camp on Comet Creek" (their camp of 28-29 December). It is worth noting that Gilbert listed the presence of "*Platycercus Paliceps*" (the Eastern Rosella *Platycercus eximius palliceps*) at Crinum Camp, near the Peak Range, on 30 January 1845, but did not list the Paradise Parrot; he had several times previously listed the two species together. Perhaps the Rolleston area was the true northern limit of the Paradise Parrot in the 1840s.

[188] A "Leichhardt Tree" is marked on the Comet 1: 100,000 map 8650 at this junction (GR 567 939).

[189] Today a bronze plaque on the Emerald-Clermont road, on the western side of Peak Range, identifies each of the peaks for the interested traveller.

[190] The Weebill is now in the NHM (1881.5.1.294), an adult male collected by Gilbert at "Peak Range Camp" on 27 January 1845. The Varied

Sittella, a female labelled "Port Essington" but in fact from the "Port Essington Expedition," is now in Philadelphia (ANSP 9178). This specimen was the model for the bottom right hand bird in the plate for "*Sitella leucocephala* White-headed Sitella" in Gould's *The Birds of Australia* (1840-1848, vol. 4, plate 102). As Gould stated in the accompanying text, it "differs … in greater purity of the white colouring of the head" from the other two birds shown in the plate. Gould also specified that Gilbert had collected this Varied Sittella on 27 January 1845 at Peak Range Camp "during Dr. Leichardt's overland expedition to Port Essington."

[191] See endnote 138. The Black-faced Woodswallow which Gould stated in his type description of *Artamus albiventris* (*Proceedings of the Zoological Society of London* 1847, 15:31) that Gilbert had collected at Peak Range Camp [on 27-28 January 1845] is probably a bird which is now in Philadelphia (ANSP 15492), labelled "Port Essington" [= Port Essington *Expedition*]. As Gould's type description specifically included this Peak Range specimen, then it must be a syntype. The other syntype of *Artamus albiventris*, Gilbert's specimen from the Darling Downs, is also probably now in Philadelphia (ANSP 15493), a female labelled "New South Wales." Gould's name *Artamus albiventris* was considered too close to John Latham's *Ocypterus albiventer* of 1831, so Richard Bowdler Sharpe renamed it *Artamus hypoleucus* (1890:17). Gould's original syntypes also stand for Sharpe's name. *Artamus hypoleucus* is now considered to be a synonym of *Artamus cinereus melanops*, a subspecies which was described by Gould in 1865 (Schodde and Mason 1999).

[192] Glen McLaren put them on a tributary of what is now called Isabella Creek.

[193] The White-winged Fairy-wren and Large-tailed Nightjar specimens have not been found, but the "*Myrafra*" is probably a Singing Bushlark specimen now in Philadelphia (ASNP 14768, labelled "Interior of Australia"), which is possibly one of the syntypes of *Mirafra horsfieldii* Gould, 1847. In his type description, Gould gave the type locality as "Interior of New South Wales" (which could have included the part of Queensland they had reached, still officially then in New South Wales). In his *Handbook* (1865, vol. 1:404) Gould added "I have also a specimen procured during Dr Leichardt's overland expedition … and one from Port Essington." The latter (ANSP 14769) is probably of the subspecies *Mirafra javanica soderbergi*.

[194] There is a specimen of Australian Spotted Crake (*Porzana fluminea* Gould, 1843) in the Gould Collection in Philadelphia, which is labelled "Port Essington" (ANSP 6251, female). The range of this species does not extend much further north than the Tropic of Capricorn, and the location must be a mistake. Perhaps this specimen was from the Port Essington **Expedition** and was the "new species of Porzana" which Gilbert first killed on 30 January 1845. Nearly a month later, when they were on the Isaacs River, Gilbert wrote in his diary for 24 February 1845 that he had "killed a second example of the little Porzana, I first

killed on Crinum Creek." Possibly only one specimen now survives because the other was later discarded by Leichhardt on the ground it was a duplicate. It is also possible that Gilbert's "new species of Porzana" was Baillon's Crake (*Porzana pusilla palustris*); there is a Baillon's Crake in National Museums Liverpool (LIVM D.5343s) which was labelled by Gilbert as having been collected on the Isaacs River, although he has recorded the date as the **23rd** February (see endnote 200).

[195] The Buff-banded Rail has not been found, but the Black-fronted Dotterel is now in National Museums Liverpool (LIVM D.5174s), a male labelled as having been collected at Crinum Camp on 1 February 1845.

[196] Unfortunately this "new Hawk" slipped from Gilbert's pack the next day. He said it had a bill and tarsi like a *Buteo* (Buzzard) but in colour was more like an "Astur Calei or Aquila Morphnoides." *Astur Calei* by synonymy is the Red Goshawk (*Erythrotriorchis radiatus*) but might equally apply to the Brown Goshawk (*Accipiter fasciatus*), as Gould had much trouble separating these two species. *Aquila morphnoides* is the Little Eagle (*Hieraaetus morphnoides*). Of the potential bird of prey species, perhaps a dark-phase Little Eagle was the most likely.

[197] Two of these specimens are now in National Museums Liverpool, the Brown Honeyeater (*Lichmera indistincta ocularis*) (LIVM D.5483s, male) and the Black Honeyeater (LIVM D.3482s, male). Both are labelled as having been collected at Crow Camp on 13 February 1845. Gilbert collected another Black Honeyeater near the Gulf of Carpentaria in June 1845 (NHM 1881.5.1.4252, female), also considerably east of the modern range of the species. Gilbert knew the Red-headed Honeyeater (*Myzomela erythrocephala*) from Port Essington, but might not have been familiar with the somewhat similar Scarlet Honeyeater. Such a specimen has unfortunately not yet been found.

[198] This Painted Snipe is also now in National Museums Liverpool and was labelled by Gilbert as having been collected at Crow Camp on 13 February 1845 (LIVM D.4863s, a young female).

[199] This was named after F. N. Isaacs, who with H. H. Hughes ran Gowrie Creek on the Darling Downs. On 14 February Gilbert pithily recorded in his diary that Mr. Isaacs was "the Gent at the Darling Downs who liberally presented the Expedition with a fine fat bullock."

[200] This was on 23 February, the date written by Gilbert on the label for a Baillon's Crake (*Porzana pusilla palustris*), a male from the "Isaacs River" (now in National Museums Liverpool, LIVM D.5343s), although Gilbert recorded that he "killed a second example of the little Porzana, I first killed on Crinum Creek" in his diary under **24th** February (see endnote 194).

[201] The Black-faced Monarch, which Gilbert called "*Monarcha carinata*" has not yet been found, although it could be one of two specimens now in Philadelphia, ANSP 1083 (female) and 1084 (an immature male with

no tail). These are both labelled "Port Essington" but this species does not occur on the north coast, and this could be in error for Port Essington *Expedition* (also see endnote 211). Gilbert's specimen would have been at the western edge of the modern range of the Black-faced Monarch. The Western Gerygone is now in the Natural History Museum (NHM 1881.5.1.297) and was collected by Gilbert at Lumbago Camp on 3 March 1845. This is is at the eastern limit of its modern distribution.

[202] This campsite name is of great importance, as it supplied the clue needed to find John Gilbert in the Mormon Geneological Index. This revealed the year of his birth (1812, the same as his now very famous colleague, the nonsense poet and artist Edward Lear, tutor to the 13th Earl of Derby's family), the place where he was born (Newington Butts, south London) and the church where he was baptised (Lady Huntingdon's Chapel in Clerkenwell, London), amongst other biographical details.

[203] They also passed the junction of a large river with the Suttor on the 27th, which they called the "Cape River" after the captain of the *Sovereign* which had transported Leichhardt and his supplies from Sydney to Brisbane.

[204] This Rufous Whistler is now in National Museums Liverpool (LIVM D.1640g).

[205] Charters Towers was the base for the Leichhardt Expedition Rally of September, 2006.

[206] Gilbert recorded that he had collected specimens of his "*new Eopsaltria*" on the Burdekin on 14 April (when they were near the Great Basalt Wall), on the 18th (when they were just south of Mount Foxton), and on the 19th (when they passed the junction of the Burdekin with Running River).

[207] Gould's type description of *Petroica superciliosa*, given in 1846, was published in 1847 in *Proceedings of the Zoological Society of London*: 106-107. Gould stated that the specimens had been collected in "The neighbourhood of the Burdekin Lakes" but had not read Gilbert's diary carefully enough to be more specific.

[208] The type series for *Petroica superciliosa* Gould appears to be: LIVM D.1983 (male) and D.1983a (female), both still bearing Gilbert's original labels and collected at the River Burdekin in April 1845; ANSP 783 (male) and 784 (female), both labelled "Interior of Australia"; RMNH (Naturalis) Leiden, Old Catalogue No1, a female from "Port Essington" [Expedition]; Museum of Victoria, Melbourne R12145, a female from the "Burdekin River"; RAMME 1944.5.4. Adult, from the Port Essington Expedition, collected by John Murphy. For comments on Murphy's collection in RAMME, see endnote 185.

[209] Gilbert recorded in his diary that he had collected specimens of Yellow Honeyeaters on 15, 16, and 19 April. Yellow Honeyeater specimens already located which can be attributed to Gilbert while he was on the

Leichhardt Expedition include a specimen now in Liverpool (LIVM D.927s, collected in June 1845, when the expedition was further north on the River Lynd) and probably at least one of two Yellow Honeyeaters (ANSP 18560, male and 18561, female, both labelled "Port Essington"), which are now in the Gould Collection in Philadelphia. Of the two Gilbert female Yellow Honeyeaters that were in the British Museum, one is still there (NHM 1855.11.5.23, labelled "Port Essington, R. Burdekin"), but the other was transferred to Lord Rothschild's collection and is now in the American Museum of Natural History in New York (NHM 1858.12.2.25 / AMNH 695701), labelled "R. Burdekin" and "Essington [Expedition]."

[210] For instance, Raymond Paynter in J. L. Peters *Checklist of Birds of the World* 1967, vol. 12:373, stated that "Field records from Northern Territory are probably due to misidentification" for the Yellow Honeyeater. Paynter might have been surprised to realise this was due to misidentification of locality, not species.

[211] Also see endnote 201. This *Monarcha*, which Gilbert collected on 19 April 1845, is possibly one of the two Black-faced Monarch specimens incorrectly marked "Port Essington"—ANSP 1083 (F) and 1084 (M immature). From this Leichhardt Expedtion locality, the other possible species of *Monarcha* would be the White-eared Monarch (*Monarcha leucotis* Gould 1850, but this was not described for another 5 years and even then from a specimen from Cape York), or the Spectacled Monarch (*Monarcha trivirgatus melanorrhoa* or *M. t. gouldii*), which would here just have been within its modern range.

[212] From the locality, Gilbert's "*Pachycephala*" of 1 May was probably either a Rufous Whistler (*Pachycephala rufiventris*) or Golden Whistler (*P. pectoralis*). It was probably a Golden Whistler, of which there is a specimen in National Museums Liverpool (LIVM D.1640h, female), labelled by Gilbert as having been collected at the Burdekin Lakes in May, 1845. Again, this is an interesting record; Golden Whistlers are now generally found only to the north-east of this area, although Bruce Lawrie considers they could still occur in the vine thickets associated with the lava flows around the Valley of Lagoons.

[213] Two Red-backed Kingfishers which were collected by Gilbert in early May 1845, both females, are now in National Museums Liverpool (LIVM D.1623a, Burdekin River, 2 May 1845; D.1623, "Burdikin Lakes," 3 May 1845). His diary, however, records that he collected specimens of Red-backed Kingfishers on **1st and 2nd** May 1845.

[214] Elsewhere in his diary (MLS, microfilm frame 967a), Gilbert also recorded the soft parts colour of his "*New Poephila*," unfortunately his notes are only partly readable: "New *Poephila* . . . May . . . on the Burdekin . . . dark greenish grey, black at tip of upper mandible, rather more than half from the tip of lower mandible black. There is a broad black band across the upper mandible near the base. Eye lash bluish grey Irides dark brown, legs . . . reddish flesh colour."

[215] Elsewhere in his diary (MLS microfilm frame 966b) Gilbert recorded a list of Aborigine words used by "The Lotus Eaters" of the Valley of Lagoons, which he also listed in his diary entry for 13 May 1845, while they were at Whitsunday Camp. These words include "*bek-lin*" (a shield) and "*we-gil*" (eating).

[216] There is a Clamorous Reed-warbler (*Acrocephalus ?stentoreus*) (I have it listed as *A. arundinaceus*) in the NHM (1881.5.1.1035, labelled "Port Essington [Expedition] . . . Gilbert's last collection. Interior of Aust," in Gould's handwriting. A Zebra Finch now in Murphy's collection at RAMME (1944.5.18, adult male) might also be the one in question. If Gilbert actually collected specimens of the two other finches he said were common at Reedy Brook Camp, then there is a candidate in a Plum-headed Finch in RAMME (1944.5.20, adult female).

[217] This must have been the more southerly of the two Pelican Lakes.

[218] Gilbert wrote that this kangaroo was very like John Gould's "*L. conspicilatus*." It is likely that this was the material from which John Gould named Leichhardt's Rat Kangaroo in 1853 (now considered to be a subspecies of Spectacled Hare-wallaby, *Lagorchestes conspicillatus leichardti*). The types are now in the Australian Museum in Sydney, a mounted adult and skin of a young animal, from "country bordering the Gulf of Carpentaria" (Palmer Register 1103 and 1103½, presented to the Australian Museum by Ludwig Leichhardt).

[219] Their camp, on a basaltic table land, is now the site of Glen Harding homestead.

[220] Robert Lynd was at this time busily composing an elegy to Leichhardt, who had been given up for dead. In following the River Lynd the expedition went too far up into Cape York and much tragedy and wasted effort ensued.

[221] The types of *Poephila leucotis* Gould 1847 are ANSP 14632 (male, lectotype) and ANSP 14633 (female), both labelled "Interior of Australia"; RAMME 1944.5.14 (male, collected by John Murphy) and possibly NHM 1884.1.10.234, an adult formerly in the collections of Thomas Eyton and W. A. Forbes, which is a good specimen but from which the legs have detached, along with the original labels. Body, legs and labels are now in a small tray, and are on the priority list for mending. The first specimen at least must have been collected in the vicinity of the River Lynd near its junction with Fulford and Mile Creeks, the stretch the expedition traversed on 2 June. In *The Birds of Australia* (1840-1848, vol. 3, text to plate 92) Gould incorrectly gave the date that Gilbert collected this new finch for the first time as **3rd** June, when they were several miles further north on the Lynd. Gilbert also recorded in his diary that he had "met with the new Poephila" on 13 June, although he did not say whether he had collected any specimens.

[222] Gilbert's Lynd River Spinifex Pigeons are probably represented by ANSP 13564 (Interior of Australia) and National Museums Liverpool LIVM D.4153s (unsexed) & D.4162s (female), which are both labelled,

"River Lynd, June 1845." Gilbert's Spinifex Pigeons from the River Lynd are important distributional records, as so many of his specimens from the Leichhardt Expedition are; this pigeon does not occur so far east in modern times.

[223] A female Yellow Honeyeater *Lichenostomus flavus* which was collected by Gilbert on the River Lynd in June 1845 is now in National Museums Liverpool (LIVM D.927s).

[224] The types of *Climacteris melanota* Gould, 1847 are probably ANSP 9215 (male) & 9214 (female), from "Port Essington Australia" [= Port Essington Expedition]; National Museums Liverpool LIVM D.5542s, a female collected by Gilbert at the River Lynd, "June 1845" and RAMME 1944.5.11, an adult labelled "Port Essington Expedition," collected by John Murphy.

[225] A female White-gaped Honeyeater collected by Gilbert on the River Lynd in June 1845 is now in National Museums Liverpool (LIVM D.1000s). The two Plumed Whistling-ducks are also in NML (LIVM D.143c, male and D.143d, female).

[226] Gilbert's notes on the Lemon-bellied Flycatcher are in CUL Gould Collection Box 5a.

[227] The types of *Psephotus chrysopterygius* Gould, 1858 are now in the NHM (1857.9.18.51 & co, collected c. 30 miles (48 km) east of Normanton in 1856 by J. R. Elsey while he was on the Gregory Expedition).

[228] The Banded Honeyeater is NHM 1881.5.1.4251. The NHM also has a sub-adult female Black Honeyeater collected by Gilbert "Near Gulf of Carpentaria. June 1845" (NHM 1881.5.1.4252). This may be the Black Honeyeater which Gilbert said he shot on 27 June, although he said this was a male in eclipse plumage.

[229] Although Leichhardt disposed of Gilbert's rock samples and "all the duplicates of our zoological specimens" on 7 October 1845 (Leichhardt 1847:427-428).

[230] Sheet for "*Biziura lobata*," Gould Collection Box 4c, CUL.

[231] Draft letter from John Gould to the 13th Earl of Derby, September 1843 (Gould Collection, NHM General Library).

[232] The only bird specimens in any museum in the world that I have seen so far, which I consider as good as those prepared by John Gilbert, are those produced by John Williams (mainly African birds), or David Parsons of the Peabody Museum, Yale, U.S.A.

[233] Letter from John Lort Stokes to John Gould, 27 June 1846, Gould Collection, NHM General Library.

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Ornithology at Auckland Museum, New Zealand

B. J. Gill[1]

ABSTRACT.—The history of ornithology at Auckland Museum is traced through four phases in the Museum's development: the foundation years (1852-1875); the Museum building in Princes Street (1876-1928); the new building in the Auckland Domain (1929-1959); and the first extension to that building (1960-2006). Between about 1875 and 1905 the bird collection was enhanced by major exchanges of specimens with local and foreign institutions. There has been continual local collecting of birds, for the last 75 years by salvage only, and the collection now numbers 13,000 specimens. No more than 340 have been collected by any one person, including staff, reflecting the general lack of sustained and systematic collecting of live birds in New Zealand. In exhibits, the Museum's first attempts to show birds in the context of their habitats were small displays of Keas (*Nestor notabilis*) and petrels, in 1886. "Habitat groups" were a constant feature of Auckland Museum's natural history displays from 1912. The bird gallery in the 1929 building, continuously improved, served for 40 years. Its replacement in the 1960 extension, containing some large and superb dioramas, remained open for 24 years. New bird exhibits were completed in 1999. Staff in charge of the bird collections have included T. F. Cheeseman, L. T. Griffin, R. A. Falla, E. G. Turbott, H. R. McKenzie, S. M. Reed, and B. J. Gill, most of whom have published actively in ornithology. Taxidermists who have prepared specimens for the collection include I. St. John, A. Reischek, C. F. Adams, L. T. Griffin, C. W. Dover, P. J. O'Brien, and D. R. Weatherley. Several bird-enthusiasts have served on the Museum's governing committee, and the Museum has many links with the Ornithological Society of New Zealand.

Modern government began in New Zealand in 1840 when a proclamation of British sovereignty made the country a dependency of the Australian colony of New South Wales. New Zealand became a separate Crown Colony the following year. European settlement accelerated, and four main towns emerged—Auckland, Wellington, Christchurch, and Dunedin—each of which acquired a major museum. Auckland Museum was founded in July 1852, just 12 years into the Colony's history. One of the Museum's stated objectives was "to collect

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specimens illustrative of the natural history of New Zealand" (Powell 1967:8). Birds were important from the start, for the founding collection comprised ". . . some handsome stuffed birds, shells, insects, and various other things amongst which an hour may be very agreeably and instructively spent" (*The New Zealander* 27 October 1852).

There are perhaps four main phases in Auckland Museum's history. The Museum began in two rooms of a farm cottage, and several temporary modest homes followed (first phase). In 1876, the Museum moved to a new building in Princes Street (second phase) and this period of development and consolidation practically coincided with the tenure of Thomas Cheeseman as Curator. Short of space for growing collections and exhibits, the Museum moved in 1929 to a new building in Auckland Domain (a large park), built as the Auckland province's First World War memorial, which remains its present home. The enlargement in space and staffing during this period (third phase) marked the transformation of Auckland Museum into a modern museum. An extension of the building in 1960, as the Second World War memorial, gave a further increase in space (fourth phase).

The curved end to the 1960 extension enclosed a large open courtyard which is currently being filled in to provide a multi-level extension that will include two basement levels and a second grand public entrance-way with a large atrium. This major project, due for completion by 2007, is the start of a fifth major phase in the Museum's history.

The original museum organisation united in 1867 with the Auckland Institute (the Auckland branch of the New Zealand Institute, or national science organisation, now called the Royal Society of New Zealand) to form the "Auckland Institute and Museum." This name lasted until it was abolished by an Act of Parliament in 1996 that altered the Museum's governance. The official name of the building that opened in 1929 as the memorial to fallen servicemen of World War I is "Auckland War Memorial Museum." This name continues but "Auckland Museum" is commonly used as a shorter alternative. The recommended institutional acronym when citing vertebrate specimens is AIM (Leviton et al. 1985).

In governance, Auckland Museum has always been independent under a committee of elected and nominated members. Unlike the national museum (Museum of New Zealand Te Papa Tongarewa) in Wellington, it is not operationally funded by the New Zealand

Government, although it has received specific government grants at intervals throughout its history. Nor is Auckland Museum run directly by Auckland's local government. However, local authorities routinely fund a large part of the Museum's costs through a statutory levy on the rate-payers within the Auckland region, and these authorities provide a proportion of the members on the Museum's governing board.

Throughout this paper there are references to the Museum's Annual Report (*Annual Report of the Auckland Institute and Museum*), first published in 1871 for the financial year 1870-1871.

FOUNDATION YEARS, 1852-1875

In its early years, Auckland Museum had a series of temporary homes. At commencement in 1852, the Museum occupied two rooms in a farm cottage on a hill above the growing town (Powell 1967), a site now occupied by the University of Auckland city campus. In 1867 the Museum moved to a large room in the present Northern Club building in Princes Street. From 1869, Auckland Museum occupied the "old Post Office," a humble wooden structure also in Princes Street.

The Museum's collections during its earliest years were under the care of a succession of local citizens, most notably John Alexander Smith (1814?-1889), the museum's founder (Park 1999). These honorary curators were mostly amateurs, and with the study of natural history in the Colony at its infancy, and no local reference books, even putting a name to some birds was a problem. In an 1856 letter from Smith to the taxidermist St. John, for example, Smith was reduced to referring to a, "Black & White Bird with Red Bill" (Park 1999), presumably an oystercatcher (*Haematopus*).

Taxidermy.—Before 1876 only one preparator of Auckland Museum birds is known. Correspondence of J. A. Smith shows that in 1856-1857 the Museum engaged the collector and taxidermist Mr. I. St. John of Nelson (northern South Island) to supply mounted native birds that he had caught and prepared locally (Park 1999). That St. John worked from afar was presumably tolerated because there were so few taxidermists in the young colony. The finished birds were packed and sent by sea to Auckland. The museum's "Journal" (first accessions register) lists 35 birds in two lots received on 8 September and 12

December 1856. A third consignment received on 16 January 1857 is not itemised. Only 13 St. John birds survived to be registered by Cheeseman after 1898. Of these, five, possibly six, can be identified in the collection today. These are the Museum's oldest surviving New Zealand stuffed birds, and among the very few surviving items from the Museum's collection before its move to the 1876 Princes Street building.

Exhibits.—The Museum opened to the public in late October 1852, and opening hours were every Wednesday and Saturday from 10 a.m. to 4 p.m. Apart from the St. John birds, little can be deduced about bird exhibits in the buildings occupied before 1876. The Museum's "Journal" shows that six "glass cases" containing stuffed local birds were donated in 1852. The species included Red-crowned Parakeet (*Cyanoramphus novaezelandiae*), New Zealand Pigeon (*Hemiphaga novaeseelandiae*), Kokako (*Callaeas cinerea*), Tui (*Prosthemadera novaeseelandiae*), Long-tailed Cuckoo (*Eudynamys taitensis*), New Zealand Kingfisher (*Halcyon sancta*), Grey Fantail (*Rhipidura fuliginosa*), and Whitehead (*Mohoua albicilla*). Some of the early exhibits did not last long. When E. B. Dickson became Honorary Curator in 1859, one of his first acts was "the removal and condemnation of several specimens of birds &c., which had decayed beyond all remedy" (Park 1999).

Lists of new accessions in the Museum's annual reports suggest that objects exhibited before 1876 included: rock slabs showing moa footprints (Dinornithiformes); moa bones and an articulated moa skeleton; several hundred bird "skins" (probably mounted) from New Zealand, Australia, North America, India, and Europe; and nests and eggs of local birds. After the St. John birds, the next-oldest surviving New Zealand mounted birds, received in 1870, are a Brown Kiwi (*Apteryx australis*) and North Island Snipe (*Coenocorypha barrierensis*). These would have been exhibited, along with two surviving foreign mounted birds: a Common Buzzard (*Buteo buteo*) from Germany received from O. Finsch in 1874 and a Common Koel (*Eudynamys scolopacea*) from Australia received before 1874.

Captain Frederick Wollaston Hutton (1836-1905).—One honorary curator who went on to prominence in New Zealand zoology was F. W. Hutton, who appears to have had charge of the collection in 1867, arranging it in the new premises after the move to the Northern Club (Park 1999). Born in Britain, he had a military career that included overseas service in the Crimean War and during the Indian Mutiny (Parton 1993). He emigrated to New Zealand with his wife and two children in 1866. After a short time at Auckland Museum at the start of his career in New Zealand, he went on to serve as curator and teacher at museums and universities in other New Zealand cities (Parton 1993, Turbott 1990a). He was a major contributor to New Zealand ornithology, including research on moa (Hutton 1892, 1897), and he co-wrote an important book that made information on local birds accessible to the public (Hutton and Drummond 1904). Hutton was elected a Fellow of the Royal Society (London) in 1892. Hutton's Shearwater (*Puffinus huttoni*) was named after him.

A MUSEUM BUILDING IN PRINCES STREET, 1876-1928

The institution passed a milestone when a new purpose-built museum building (Figure 1) was erected on the site of the previously-occupied "old Post Office" in Princes Street. It was officially opened on 5

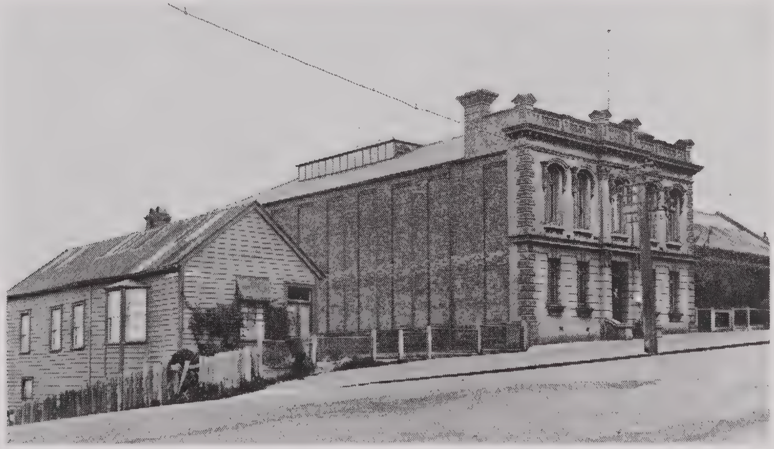

Figure 1. Auckland Museum, Princes Street, before 1929. Caretaker's cottage to left and extensions to main building to right. The skylight in the roof illuminated the Main Hall and its upstairs gallery. Cheeseman's office was behind the two windows at ground level left of the central entrance. Photograph: Auckland Museum C6122.

June 1876 by the Governor, the Marquis of Normanby (Cheeseman 1917). This building was extended several times, served as the Museum's home for 53 years, was sold and eventually demolished (Wolfe 2001).

Thomas Frederic(k) Cheeseman (1845-1923).—The Museum's residence in the new building, and the tenure of T. F. Cheeseman as the Museum's Curator, coincided almost exactly. Both were major factors in the Museum's gradual transformation from amateur to professional. Cheeseman (Figure 2) was appointed sole curator in 1874 and headed the Museum for the next half-century until his death (Cockayne 1923, Goulding 1996). Under Cheeseman's steady, energetic, and meticulous guidance the Museum became a major public institution, and Cheeseman promoted exhibits, collections, and research with vigour. He devoted much effort to expanding the collections, particularly by

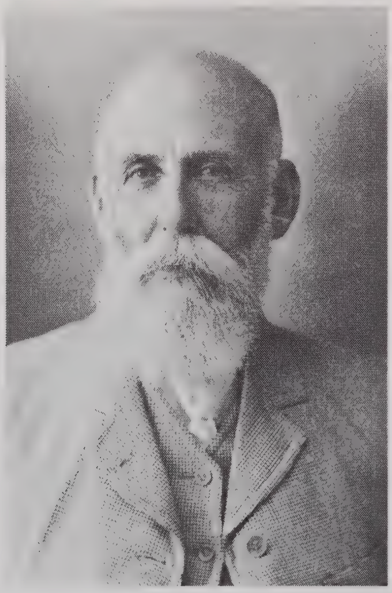

Figure 2. T. F. Cheeseman, c. 1915, towards the end of his long museum career. Photograph: Auckland Museum C6141.

exchange with other museums, and he presided over the several extensions to the building that accommodated the growing exhibits.

Born in Yorkshire, England, Cheeseman came to New Zealand with his parents at eight years old and was educated in Auckland. University training was not then available and he was essentially a self-taught biologist. Cheeseman was primarily a botanist, but published also on zoology and ethnology. He wrote several papers on birds (e.g., Cheeseman 1889, 1891). Among many honours he was elected a Fellow of the New Zealand Institute, and of the Linnean and Zoological societies of London. Cheeseman lived in a suburb a few miles from the Museum, and in the earlier years he is said to have ridden a horse to work (Figure 3).

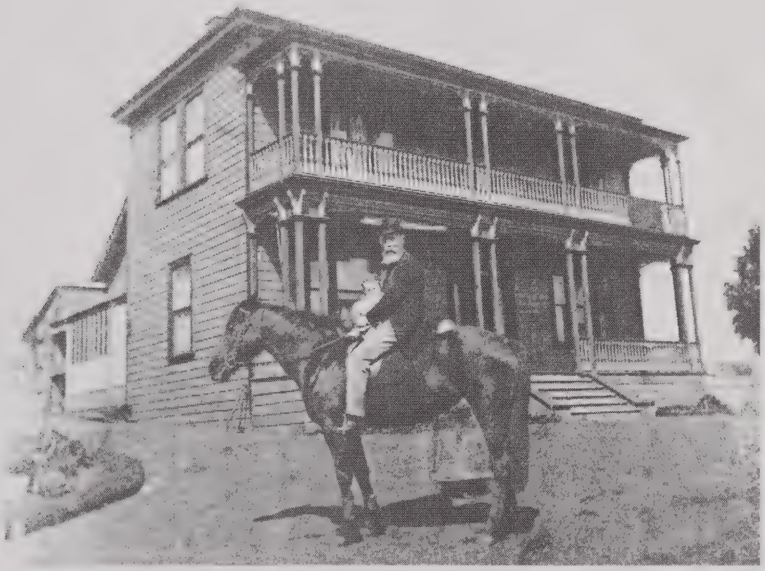

Figure 3. T. F. Cheeseman with his daughter Dorothy at their home in the suburb of Remuera, c. 1892. Photograph: Auckland Museum C27045.

A major scientific institution.—In the late 1800s, Auckland Museum became established as "one of the chief scientific institutions in New Zealand" (Cheeseman 1917), alongside the other museums, the New Zealand Institute, some small government agencies (Geological Survey, Colonial Laboratory, etc.) and, from 1869, the developing universities. Museums held this prominent scientific role in New Zealand until by the 1920s they were overshadowed by the growth of the universities and the rise of large government research departments. Government agencies that studied birds (Wildlife Branch and Animal Ecology Division) did not form until the 1940s. In keeping with the important scientific role, the directors of New Zealand museums were mostly scientists themselves from the 1800s to the 1970s.

Public interest in protecting wild birds was not fully awakened until the 1920s, with the formation of the Native Bird Protection Society (later Royal Forest and Bird Protection Society) in 1923. It is therefore not surprising that in the 1890s, it fell to Auckland Museum and its Institute members to lobby the government to purchase Little Barrier Island as a bird sanctuary. The Institute used special government grants to employ the island's first resident caretaker from 1897 to 1905, when control of the island passed to the Tourist Department (Hamilton 1961).

The great exchanges, 1875-1905.—Cheeseman corresponded prolifically with colleagues at home and abroad, often seeking to exchange specimens (see Goulding 1974, 1975, 1976, for Auckland Museum's botanical exchanges). During the 30 years between about 1875 and 1905, major exchanges were made with New Zealand and foreign museums and with foreign dealers in natural history specimens (e.g., Garnier and H. A. Ward). Cheeseman could offer many exotic objects likely to interest foreign parties. Large numbers of kiwi specimens were sent; also moa bones, Tuataras (*Sphenodon punctatus*) (reptiles), and ethnographic items. In one year, the Museum purchased 200 New Zealand bird skins from local sources, "partly for exchange with foreign Museums" (Annual Report 1878-1879:9). In the 1883-1884 year, lack of storage space forced Cheeseman to "suspend the usual exchanges with foreign museums."

The main exchange partners for birds were: the natural history museums in Paris (1877-1878), Geneva (1878-1881), and Florence (1881-1892); Otago Museum (Dunedin, 1876-1877); Canterbury Museum (Christchurch, 1876-1882); the Australian Museum (Sydney, 1878-1879); Garnier (of Lucknow, Ontario, Canada; 1881-1883); and the Smithsonian Institution (1886-1892).

An example of an exchange is that in 1881 with the natural history dealer H. A. Ward of Rochester, New York, USA., who in the course of his business helped enrich U.S. museums during the period of rapid development of popular museums in the 1870s and 1880s (Kohlstedt 1980). The stimulus for the exchange was presumably a visit to Auckland by Ward (Annual Report 1881-1882:7). Ward gave or sent Cheeseman a hand-written and signed note dated 28 March 1881: "I have this day received from Mr. T. F. Cheesman [sic] various specimens of Natural History valued at £55.10.0 (including 12 skins of Apteryx [kiwi] still to be sent me.) In exchange for these specimens I hereby agree to send to the Auckland Institute and Museum a certain series of Casts of Celebrated Fossils . . . [to the value of] $268.25 = £55.10.0 . . . ."

A list in Cheeseman's hand shows what he gave to Ward: 24 New Zealand bird skins; 17 kiwi skins, skeletons or eggs; a "moa track" (i.e., fossilised footprint/s); four geckos; a seal skull; a whale skull; a hornbill; 15 bird skins and seven ethnographic items from Melanesia ("duplicates from Mr Goldie's New Guinea collections"); 47 Maori items (mainly stone implements); and a specimen of nickel. Among the plaster casts that Ward sent, were a tarsometatarsus and egg of the elephant bird (*Aepyornis* sp.).

Other accessions.—During this period, other notable collections received were: birds from Pacific islands (especially New Britain and New Ireland) purchased from George Brown (received 1876-1877, 1882-1883); 110 bird skins from New Guinea purchased from A. Goldie (1879-1880); 24 hummingbird skins presented by O. Finsch (1881-1882); Kermadec Islands birds purchased from Roy Bell and his family (1888-1891, 1911-1912); bird skins from the Chatham Islands purchased from S. Dannefaerd (1911-1919); a selection of skins of Western Samoan birds (collected in 1924) provided by the Whitney South Sea Expedition (American Museum of Natural History) as a condition of the collecting permit issued by the New Zealand Government (the colonial power).

Taxidermy.—Many of the mounted birds received by the Museum in the late 1800s, including those exchanged internationally, seem to have arrived in an unfinished condition and required further taxidermy before they could be displayed. A constant refrain in the Museum's Annual Reports over several decades was the Museum's inability to find, or afford to pay, a taxidermist. There seem to have been no local commercial taxidermy establishments. In 1878-1879, some 300 birds were mounted for exhibition (Annual Report 1878-1879:10) implying some access to a taxidermist. However, the following year it was noted that all mammals and birds received in the past two years were "still packed away in cases, the funds of the Institute not being sufficient to defray the salary of a taxidermist" (Annual Report 1879-1880:9).

Cheeseman's sister Emma developed taxidermy skills, presumably in response to her brother's need. She is known to have prepared numerous skins of birds hunted locally by her brother W. J. Cheeseman (William), making something of a family industry. Many of these skins survive in the Auckland Museum collection and others were probably exchanged world-wide.

Exhibits.—The Princes Street building began with a single exhibition hall (later called the "Main Hall"), comprising ground floor and an upstairs gallery on four sides around a central void (Wolfe 2001). Illumination was initially by natural light from a skylight in the ceiling; gas lighting was installed later. Cheeseman's office was at the front of the building beside the main door which opened directly to the street (Figure 1). In October 1892, an "Ethnological Hall" was opened off the Main Hall and the Maori and other ethnographic collections were moved there making more room for natural history in the Main Hall. A third hall ("Statue Hall") was opened in October 1897 to contain plaster copies of classical statues, hitherto displayed in the Main Hall, and to serve as a meeting room. This meant that the Main Hall could be devoted entirely to natural history including birds. In 1905, an annex to the Ethnological Hall was completed for the Maori collections and a carved meeting house.

Among the first birds exhibited in the new museum galleries were foreign species exchanged with Otago Museum (Dunedin), New Zealand birds and a skeleton of Greater Rhea (*Rhea americana*) exchanged with Canterbury Museum (Christchurch), and 100 birds from New Ireland and New Britain purchased from G. Brown. Photographs of the Main Hall before adjoining halls were added show jumbled and tightly-packed displays, with articulated skeletons, zoological wet specimens in display jars, and deer antlers, all juxtaposed with Maori carvings and classical statues.

Improvements were made over the years to the arrangement of mounted birds in display cases. In 1892 the taxonomic groups of foreign birds were rearranged and given "printed descriptive labels, accompanied with maps showing their geographical distribution" (Annual Report 1893-1894). In the same year a case was set up displaying complete sets of leg-bones of moa.

Growth of the collections meant that display space was always limited in the Princes Street building despite extensions. There was little storage space for duplicate material and "practically everything in the old museum had to be crammed into the cases in the exhibition galleries" (Powell 1967:39). The Museum exhibited foreign as well as native birds, thus contributing to the entertainment and education of the people of Auckland at a time when there was no local zoo and books illustrated in colour were expensive. In the late nineteenth century, Auckland Museum had around 100 visitors per day on weekdays, and 200 on Sundays, which were about one-third as many visitors as the Australian Museum in Sydney attracted at the same period (Bather 1895).

Andreas Reischek (1845-1902).—A temporary solution to Auckland Museum's taxidermy problem came from Reischek, an Austrian, who was an energetic hunter and accomplished taxidermist (King 1981, Westerskov 1990a, Prebble 1993). He spent 12 years in New Zealand, from 1877 to 1889, and was employed at Auckland Museum during the period 1880-1881. His engagement was made possible by a donation of £25 from a private benefactor, and by the raising of over £60 by a "Conversazione" held at the museum on two evenings in September 1880 (Annual Report 1880-1881:9, Powell 1967:16). Thomas Broun, writing to Cheeseman in September 1880, commented on the standard of Reischek's birds: "I carefully studied the attitudes of those set up by Mr. Reischek, and … it at once assured me that his heart was in the work, one bird treated as those had been is worth a hundred in the usual formal style." There was another fund-raising conversazione in June 1881 (King 1981:66).

Reischek specimens surviving at Auckland Museum were collected or received between 1878 and 1888, suggesting that bird skins and skeletons were also purchased from him before and after his time at Auckland. Auckland Museum gave Reischek a citation dated February 1889, signed by Cheeseman and the president and vice-president of the Museum's governing body (Aubrecht 1995). It records appreciation of the "valuable services rendered to the cause of science in New Zealand by Mr. A. Reischek," referring to "12 years of unwearying and enthusiastic devotion in studying the Natural History and more particularly the Ornithology of the Colony," and to his "valuable and generous aid in enriching the Natural History Collections in the Museums of the Colony."

Reischek took a large collection of New Zealand birds back to Austria, which is now in the Naturhistorisches Museum Wien (Westerskov 1990b). At the time of writing (2006), a Reischek mounted bird (South Island Saddleback *Philesturnus carunculatus*) still serves on exhibition in the Auckland Museum natural history galleries, proving the enduring legacy of his collecting. However, Reischek is criticised by conservationists today for the number of birds he collected, particularly Stitchbirds (*Notiomystis cincta*) on Little Barrier Island. He is also vilified in some quarters as he is believed to have stolen ethnographic items against the wishes of local Maori.

Charles F. Adams (1857-1892).—Further access to taxidermy came soon after Reischek's departure. Henry A. Ward, the American dealer in natural history specimens, helped Auckland Museum to recruit a taxidermist—C. F. Adams—who was trained at Ward's own establishment in Rochester, New York. Adams worked at Auckland Museum in 1885 and 1886, where his skill in mounting birds for the displays was much praised (Gill 2004). Adams left Auckland early in 1887, visiting the main New Zealand cities, and then travelled via eastern Australia to British North Borneo (now Sabah, Malaysia), where he collected mammals and birds. He returned to the United States in 1888.

Pioneering dioramas.—In 1886, Auckland Museum went beyond individual animals in glass cases, and produced two "habitat groups." These were, "a special group, showing the nature of the habitat and special surroundings of the Tuatara Lizard (*Sphenodon*), and a similar one of the Kea Parrot" (Annual Report 1886-1887). Adams presumably mounted the animals and modelled the backgrounds, thus making the dioramas possible. H. A. Ward visited Auckland around 1881. He was well known as an advisor to museums (Kohlstedt 1980), and may have helped inspire the notion of dioramas in Cheeseman's mind.

The tuatara diorama, was a small case on legs, about 1.5 m wide, glazed only at the front and with a painted scene at the back. It depicted the lizard-like tuatara and the seabirds whose nesting burrows it may share. There were four or five Tuataras, and either three shearwaters, or two shearwaters and a diving-petrel (Gill 2004). The specimens were collected on Karewa Island by C. F. Adams in 1886.

A second diorama depicted a group of Keas (alpine parrots) (*Nestor notabilis*) feeding on a dead lamb. Adams was presumably the taxidermist and diorama-maker, but the backdrop is thought to have been painted by local artist Kennett Watkins (Wolfe 1998). These small dioramas were probably pioneering for New Zealand museums. In United States museums, the move towards displaying natural history specimens in their natural contexts in "habitat groups" began in about 1879 following earlier precedents in Britain (Kohlstedt 1980).

Louis Thomas Griffin (1871-1935).—The lack of taxidermy skills continued to be lamented, the Annual Report of 1900-1901, for example, noting that: "The Zoological department is practically at a standstill from the inability of the Institute to employ a taxidermist." The last such complaint was in the 1907-1908 Annual Report where it was stated that New Zealand's other main museums each had a taxidermist on the permanent staff. Finally, in 1908, it was resolved to employ someone, and

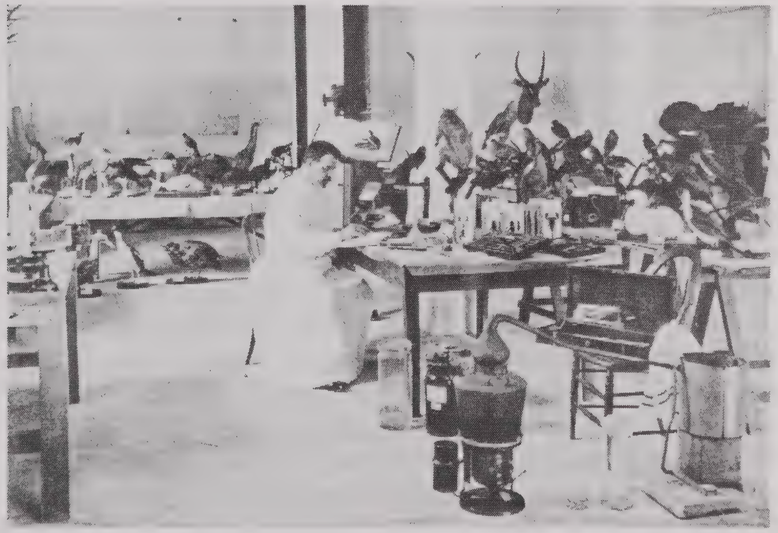

Figure 4. L. T. Griffin in a basement workroom at Auckland Museum, 1909. Photograph: "New Zealand Graphic" 3 March 1909 (Auckland Museum C8689).

following enquiries overseas, L. T. Griffin (Figure 4) was recruited from South Africa. His role was assistant (to Cheeseman) and preparator. He had trained at Regent's Park Zoo, London, had worked at Pretoria's National Zoological Garden (Wood 1992), and as a preparator at museums in Cape Town and Pretoria. Besides working at Auckland Museum, he was also advisor and later part-time Curator of Auckland Zoo.

Within a year of Griffin's appointment, all the exhibited birds were "cleaned and renovated, and remounted in a more modern style" (Annual Report 1909-1910). Many inferior and faded New Zealand birds were replaced by better and "more artistically-mounted examples." Among his activities in the 1911-1912 year he mounted 81 reptiles, birds, and mammals, as well as preparing study-skins, alcoholic specimens, skeletons, and casts. He built a reconstruction of the South Island Giant Moa (*Dinornis robustus*) (Figure 19) around 1913 using emu feathers, and mounted several large specimens, including an Ostrich (*Struthio camelus*), for a new case containing ratite birds. With Griffin's appointment, taxidermy became available to the Museum on a continuing basis for the first time. He died in office in 1935.

More dioramas.—In 1912 there was further progress towards display dioramas when a large group of Pied Shags (*Phalacrocorax varius*) was prepared with a painted background. An attempt was made to "show a small colony of the bird in its usual breeding habitat of the upper branches of the pohutukawa tree [*Metrosideros*], the nests, eggs, young, and several examples of both sexes in the adult stage" (Annual Report 1912-1913). Two years later a similar group illustrating the Spotted Shag (*Stictocarbo punctatus*) was installed (Annual Report 1914-1915; Figure 5). This group, containing adults in breeding plumage, nests, eggs, and chicks was an "exact representation" of a part of the breeding colony at Shag Rock, Firth of Thames. The specimens were collected and mounted by Griffin, and Kennett Watkins painted the background. These were followed by cases exhibiting habitat groups of Brown Kiwis (*Apteryx australis*; Annual Report 1915-1916) and White-fronted Terns (*Sterna striata*; Annual Report 1918-19).

However, space was still limited: " . . . a glance at the show-cases containing the New Zealand birds will prove that no space remains for further additions. The preparation of special groups illustrating the life history of New Zealand birds, which have proved to be such popular

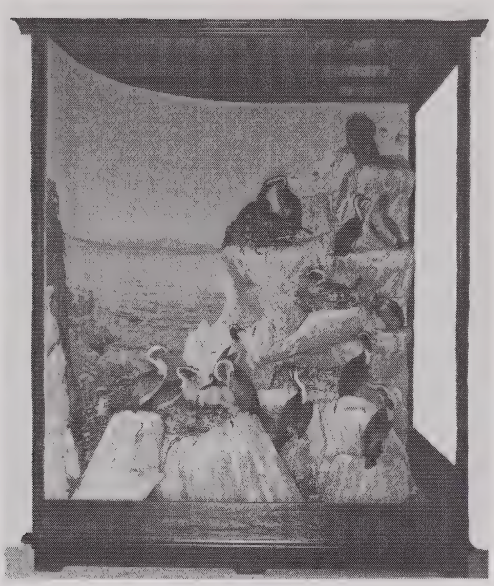

Figure 5. Habitat group of Spotted Shags *Stictocarbo punctatus* completed 1914-1915. Photograph: Auckland Museum.

exhibits, has had to be suspended, there being no available space in which to place the show-cases" (Annual Report 1918-1919).

Moa reconstruction and giant moa skeleton.—In 1912 a successful public appeal was made to raise £700 to purchase some Maori carvings and set up a plate-glass case containing a moa "restoration," a large moa skeleton, and mounted examples of various living ratites. In 1912 an articulated skeleton (comprising plaster casts) of the largest moa (*Dinornis robustus*) was received from Mr. Damon, an English dealer. This, and Griffin's reconstruction of the same species, are both three metres tall. The ratite display was placed in the centre of the Main Hall and inaugurated by a conversazione, on the evening of 8 October 1913, attended by about 550 people. Both the skeleton and reconstruction of the giant moa have been exhibited ever since, and are usually considered to be the second most popular attraction in the Museum after the Maori carvings.

After 40 years the Princes Street building, despite its extensions, was too small, and Cheeseman (1917) lamented the lack of space for new exhibits, the existing exhibits "so crowded that they cannot be properly examined by visitors," the few facilities for scientific research, and the lack of storage for duplicate specimens intended for exchange. "Finally, the present workrooms [Figure 4], though spacious enough, are badly lighted and insufficiently ventilated, and so damp that, with the exception of minerals, no specimens can be stored therein without grave risk of injury." In 1928, the exhibits at Princes Street were dismantled for removal to the new building.

A NEW BUILDING IN THE DOMAIN, 1929-1959

After many years of planning and fund-raising, Auckland Museum's new building (Figure 6), on a hill in the Auckland Domain, was opened on 28 November 1929 by the Governor-General, General Sir Charles Fergusson. Cheeseman did not live to see the realisation of his dream. One of the finest public buildings in New Zealand, and superbly sited, it was designed by the local architectural firm of

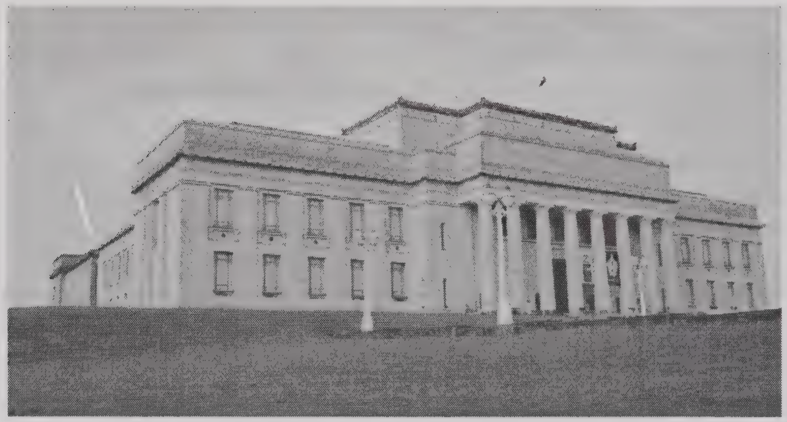

Figure 6. The north-facing front of the 1929 Auckland War Memorial Museum, taken in 1998. The line marks the point behind which the extension to the south was completed in 1960. Photograph: B. Gill.

Grierson, Aimer, and Draffin after an international design competition (Wolfe 2004). It is the memorial to those from the Auckland provincial district who died in the Great War (1914-1918). It contains three floors, devoted then, as now, largely to display galleries.

The move to the new building enabled a modernisation of Auckland Museum. There was room to separate objects for display from those to be held in storage for reference only, and the modern approach could be adopted of exhibiting selected items rather than having cases crammed with all the Museum's objects. Secondly, the complement of staff increased beyond Curator and Assistant, with improving funding and the recognition that collections needed to be curated by specialists. In 1930 there was a Conchologist-Palaeontologist (A. W. B. Powell), a Botanist (Lucy Cranwell) and an Honorary Ornithologist (R. A. Falla).

Also in 1930, the Museum began annual publication of a scholarly periodical, *Records of the Auckland Institute and Museum* (Furey and

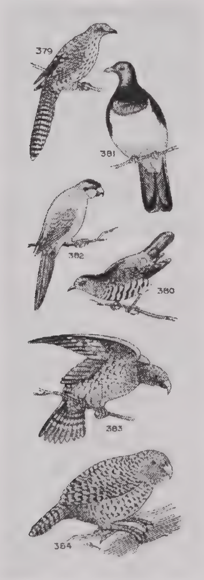

Figure 7. Bird illustrations (Long-tailed Cuckoo, New Zealand Pigeon, Red-crowned Parakeet, Shining Cuckoo *Chalcites lucidus*, Kea and Kakapo *Strigops habroptilus*) from Powell's highly successful popular book *Native Animals of New Zealand*, published by Auckland Museum in 1947. From page 84 of the 1961 printing.

Gill 1998, Gill 2005). This was intended as an outlet for research by staff and to be used in exchange to obtain serials for the Museum Library. To date the *Records* contain more than 20 ornithological papers.

The building was new, but finances were still tight, and new and proper storage furniture was beyond the Museum's means in the 1930s. The bird skins were stored on two sizes of wooden trays in recycled cupboards, including old glass-fronted exhibition cases from the Princes Street building with the glass painted over. Some proper skin cabinets were provided for the bird collection around the 1960s, but only as an adjunct to inferior cabinets that were not replaced until 1991.

In 1947, the Museum published a book *Native Animals of New Zealand*, with text and exquisite line drawings (Figure 7) by Baden Powell, the Museum's conchologist, who had trained as a commercial draughtsman. It covers common native animals, including a selection of birds, and is clear, straightforward, and inexpensive. As a result it remains in print, with more than 150,000 sold, and is New Zealand's biggest-selling nature book.

Sir Gilbert Edward Archey (1890-1974).—The position of Curator was filled in 1924 by Gilbert Archey (Figure 8), who, like Cheeseman, was Yorkshire-born, and who came to New Zealand with his parents at the age of two. The title of Curator was changed to Director in 1929 with the move to the new building. Archey set about making the rehoused Museum a thoroughly educational institution through informative displays, a wide-ranging lecture programme, and visits to the Museum by local schools. In 1935, he was instrumental in attracting a grant of $US50,000 from the Carnegie Corporation of New York to establish School Service officers in each of the four main New Zealand museums.

Scientific staff were left in no doubt that their main duty at Auckland Museum was public service (including exhibitions), but attention to research was not forgotten. Archey had broad interests and pursued zoology early in his career, later diverting much attention to the study of Maori art (Turbott 1975, Morton 1998). He amassed most of the Museum's large moa bone collection and published a major study of moa (Archey 1941) for which he was awarded a D.Sc. by the University of New Zealand. He directed the Museum from a desk in the corner of the wood-panelled boardroom, retiring intermittently, and on evenings,

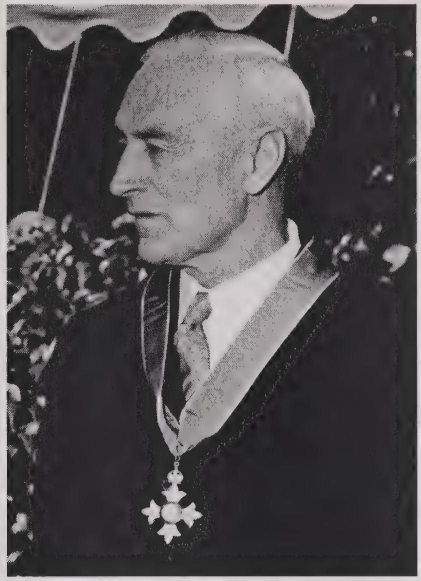

Figure 8. G. E. Archey, c. 1958. He wears the insignia of C.B.E. (Commander of the British Empire), an honour he received in 1958, five years before his knighthood. Photograph: N.Z. Herald collection, Auckland Museum.

to the quiet of a spartan workroom in a vacant lift-shaft at the top of the building where he could pursue his writing. His career was interrupted by war service: with the New Zealand Field Artillery in France during the Great War, with the home forces from 1939, and then with the British Military Administration in Malaya (as Lieutenant-Colonel) until 1947. He was knighted in 1963 and retired the following year.

Sir Robert Alexander Falla (1901-1979).—Bob Falla (Figure 9), born in Palmerston North, was appointed Honorary Ornithologist in 1929, one of the first specialist curators. He was granted leave from, and later left, Auckland Teachers' Training College to work as Assistant Zoologist on Sir Douglas Mawson's British, Australian, New Zealand Antarctic Research (BANZAR) Expeditions during the summers of 1929-30 and 1930-31. In preparation for the first expedition he spent

Figure 9. R. A. Falla at about the time of his employment at Auckland Museum. Photograph courtesy of the Falla family.

time in Australia learning to make study-skins. During the expeditions, sections of the Antarctic coast were charted, and formalities were conducted proclaiming the Australian Antarctic Territory.

Falla took up a permanent position as Ornithologist at the Museum in 1931 and published actively on birds, including papers in the Museum's own *Records* (e.g., Falla 1934, 1935). He worked on the BANZARE bird collection, which remains at Auckland Museum, and the published report of the ornithology of the expeditions (Falla 1937) earned Falla the D.Sc. degree from the University of New Zealand. He left Auckland Museum in 1937 to become Director at Canterbury Museum, Christchurch. Falla went on to become the leading New Zealand ornithologist of his generation, active in research, a populariser of ornithology through frequent talks and radio broadcasts, and an advocate for conservation (Fleming 1980).

Evan Graham Turbott (1914-).—In 1937, Graham Turbott (Figure 10), who was born in Auckland, was appointed Assistant Zoologist, which included care of the bird collection. His M.Sc. thesis, at the

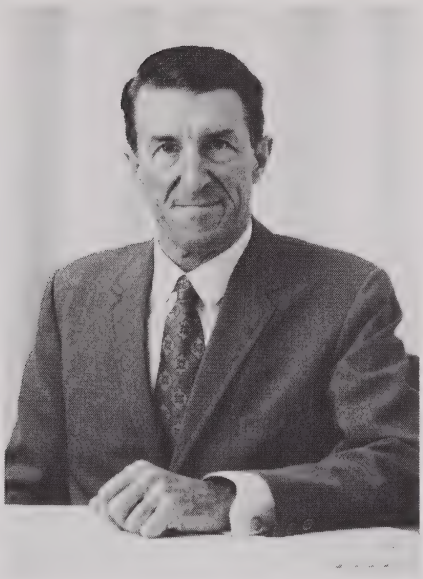

Figure 10. E. G. Turbott taken before his retirement in 1979 as Director of Auckland Museum. Photograph: Auckland Museum.

University of Auckland, had concerned the biology of a New Zealand native frog (*Leiopelma* sp.), but his main research interest was to be birds. In the summer of 1937-1938, Turbott accompanied Charles Fleming on an ornithological expedition to the Chatham Islands (Fleming 1939a,b), and in 1940 he married Olwyn Rutherford, Ethnologist at Auckland Museum. New Zealand was at war with Germany from 1939, but the war came closer to home when Japan commenced hostilities in December 1941. With the fall of Singapore in February 1942 and the bombing of Darwin the following month, " . . . normal routine was subordinated to the packing for removal to places of safety of representative collections . . . [including] the whole of the spirit material" (Annual Report 1941-1942). Spirit birds and type specimens were taken to underground storage in lava caves on private property at the foot of Mt. Eden in a nearby suburb. Sand-bags were installed around certain exhibits in the galleries.

From 1943 to 1945, Turbott was absent from his Museum position on war service that included a year at the coast-watching station on the subantarctic Auckland Islands as part of the "Cape Expedition" (Turbott 2002). Lake Turbott on Adams Island is named after him. From 1945 he was Ornithologist-Entomologist. During this period, Graham Turbott made improvements to the Bird Hall, did field work in Fiordland following rediscovery of the Takahe or Notornis (*Porphyrio mantelli*), published papers on the birds of offshore islands (Turbott 1940, 1947a, Turbott and Buddle 1948, Turbott and Bull 1954) and on shags (Turbott 1956), participated in the Danish deep sea "Galathea" expedition (1952), and wrote a popular book on New Zealand birds (Turbott 1947b). In 1955, the Museum mounted a temporary exhibition called "The Bird Book" that covered the history of bird illustrations using volumes from the Museum Library. Turbott left in 1957 for a position at Canterbury Museum.

Major Geoffrey Armstrong Buddle (1887-1951).—Buddle (Figure 11) was a veteran of the Gallipoli campaign of World War I, serving with the Royal Engineers (Sibson 1975a). In France he helped build a bridge while under fire, for which bravery he was awarded the D.S.O. Later he was badly gassed and needed much convalescence to regain his health. In 1937, he participated in the Total Solar Eclipse Expedition to the Phoenix Islands, which led to a paper on the birds of Canton Island (now part of Kiribati) in the Museum *Records* (Buddle 1938). During Turbott's absence on war service, Major Buddle was Acting Ornithologist. He continued as part-time Associate Ornithologist from 1945 until his death, and in that time he catalogued much of the egg collection. He had been an egg collector himself, and the Museum later received his important collection. Buddle published several ornithological papers (e.g., Buddle 1938, 1939, 1941, Turbott and Buddle 1948). He was a pioneering nature photographer, and wrote a popular bird book illustrated with his own photographs (Buddle 1951).

Museum expeditions.—Ornithological field work was a component of expeditions to some of New Zealand's offshore islands organised or joined by Auckland Museum staff. In February 1934, an expedition to the Three Kings Islands on the ketch *Will Watch* (with Turbott, then a student, and Falla) also visited other island groups on the return leg. In January-February 1937, Falla, Turbott, and Buddle visited Hen Island (joint expedition with Auckland University Field Club). Buddle joined a trip to the Three Kings in November-December 1945 aboard the

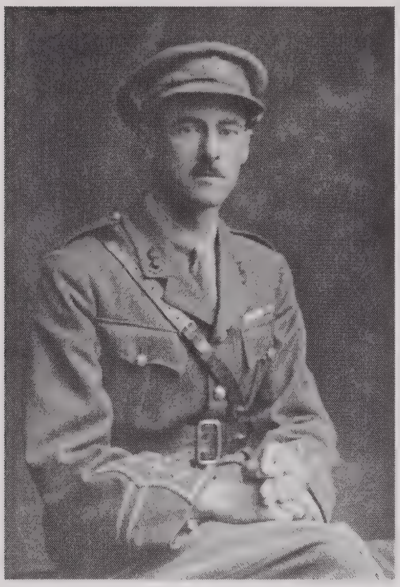

Figure 11. G. A. Buddle, probably taken early in the First World War (1914-1918) when he was with the British Army's Royal Engineers. Photograph: Sibson collection, Auckland Museum.

corvette HMNZS *Arbutus*. In April-May 1946, Turbott returned to the Three Kings on MV *Golden Hind* (joint expedition with Internal Affairs Department). Buddle went to outer island groups on the yacht *Rosemary* in 1947 and 1948. Turbott returned to the Three Kings in 1948 (on MV *Alert*, with Buddle), 1951 (on MV *Ocean Star*, with Archey) and 1952-1953 (on the yacht *Tara*, with Archey). There were trips for Turbott and Buddle to Little Barrier Island in 1945 and 1947. In 1950, Turbott joined an expedition to the Antipodes and Bounty Islands organised by the Dominion Museum (Wellington).

Charles W. Dover.—Dover (Figure 12), an accomplished taxidermist of the British school, was appointed as Preparator in 1929 and served 24 years until 1953, when he was succeeded for the next five

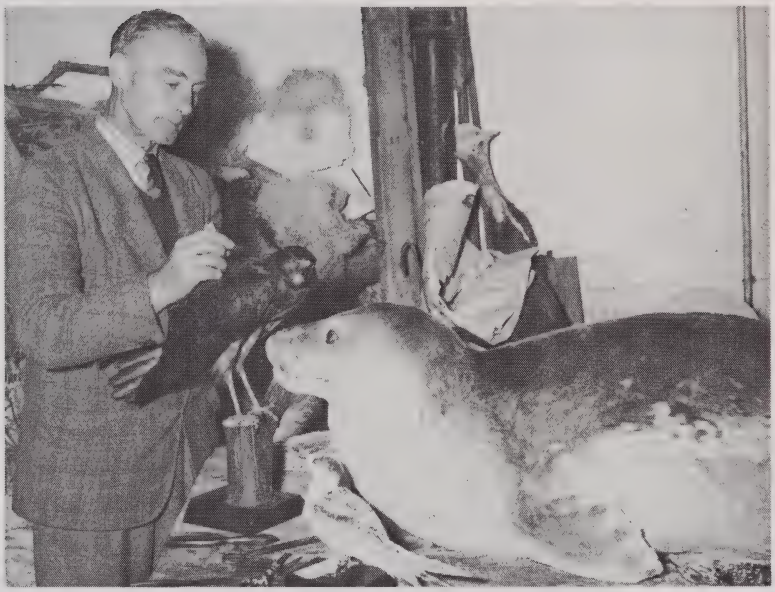

Figure 12. C. W. Dover, taxidermist at Auckland Museum, taken before 1954. Photograph: Auckland Museum AM93.A891.13a.

years by Pat J. O'Brien. Dover prepared excellent mounts and study-skins, redid field skins prepared by Falla and Turbott, prepared mounts and skins from spirit specimens, and relaxed mounts. He articulated moa skeletons collected by Archey, but his largest job was mounting an Indian elephant ("Rajah") that had come from Auckland Zoo. Among tasks he was diverted to during war years was the production of sets of models of tropical fruits for Royal New Zealand Air Force "instructional depots" (Annual Report 1944-1945).

First Bird Hall.—A Hall of New Zealand Bird Life was in place in the north-east gallery on the first floor at the Museum's opening in November 1929. However, it was constantly added to, and improved, through to the 1950s (Figure 13). The Pied Shag, Spotted Shag, and Brown Kiwi habitat groups from Princes Street were installed along the east wall of the gallery. New groups were added as they were developed, such as a group of Australasian Gannets (*Morus serrator*) in 1930-1931 and Subantarctic and Antarctic habitat groups the following year. Some of the specimens for the new displays were shot locally by

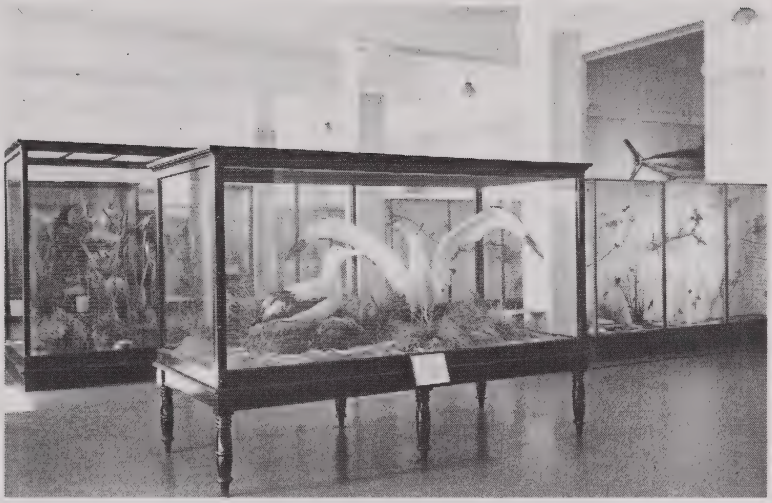

Figure 13. General view of the First Bird Hall, c. 1960, showing the centrally placed "habitat group" illustrating the courtship display of the Wandering Albatross (*Diomedea exulans*). Photograph: E. G. Turbott.

Falla, and prepared by Dover. Thus the Museum was able to display many fresh and well-prepared specimens that were re-used in later displays. The 1930s were the last decade in which Auckland Museum staff regularly killed birds for the collection—subsequent collecting has been mostly by salvage of dead birds.

At first the gallery was lit by natural daylight from windows, and many birds suffered serious fading. In 1940-1941, there were experiments with artificial lighting in the deeper cases containing habitat displays. In about 1950, the power supply for displays was changed from direct to alternating current, permitting use of fluorescent lighting for the first time. Type-written labels were progressively replaced with printed labels in more legible type from about 1946. The 1929 bird gallery remained intact until about 1969 when work began on a new bird hall elsewhere on the same floor.

The Museum's large collection of foreign-mounted birds was displayed in a Hall of General Natural History in the largest gallery on the west side of the first floor (currently the Oceans Gallery). The Annual Report for 1935-1936 refers to a new arrangement of birds of paradise in this gallery and a "natural habitat group of pheasants." Moa and foreign ratite birds were displayed in the Hall of New Zealand Geology, on the north-west corner of the first floor (currently occupied by a volcanoes exhibition).

Important accessions.—Significant collections received during 1929-1959 include: birds from Antarctica obtained by the British, Australian, New Zealand Antarctic Research Expedition, 1929-1931; the J. C. McLean and G. A. Buddle collections of New Zealand birds' eggs; study-skins from Ceylon (Sri Lanka), presented by A. R. Hughes 1930-1932 (Hughes was honorary New Zealand government agent in Colombo); birds from New Zealand and Hawaii collected by G. C. and H. S. Munro in the late 1800s (G. C. Munro was honorary Associate in Ornithology at the Bishop Museum, Hawaii); Solomon Islands birds collected by A. T. Pycroft, 1932.

FIRST EXTENSION, 1960-2006

The 1929 building was nearly doubled in size by an extension to the rear (south) in memory of those service-men and -women from the Auckland provincial area who lost their lives in World War II (1939-1945). Work began on the extension in 1956 and it was opened on 19 March 1960 by the Governor-General, the Viscount Cobham (Powell 1967). The extension contains additional gallery spaces on three floors connecting with those in the front part of the building. The curved rear portion of the extension contains administrative and storage areas on four floors.

Lois Wagener (née Bishop; Figure 14) was Recorder (Zoology) from 1960 to 1968, during which time she managed the bird collection and prepared material for it, particularly bones. Graham Turbott returned to Auckland Museum as Director from 1964 until his retirement in 1979. He planned and oversaw creation of the new bird hall, co-authored a field guide to New Zealand birds (Falla *et al.* 1966, and later editions) and edited a reprint of Buller's famous bird book (Turbott 1967). During this period the Museum published a booklet to assist identification of seabirds (Croxall 1971). Turbott served on several scientific committees, including the national Fauna Protection Advisory Council, and the local Hauraki Gulf Maritime Park Board. He was elected a Fellow of the Art Galleries and Museums Association of New Zealand in recognition of outstanding service to museums, and in 1977 he received the Queen's Service Order.

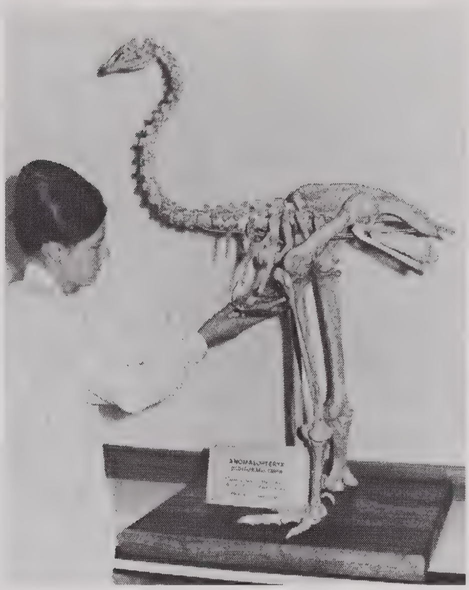

Figure 14. L. J. Wagener in December 1967 with a moa skeleton (*Anomalopteryx didiformis*) that she articulated. Photograph: Auckland Museum C25198.

Hector Ross McKenzie (1897-1981).—With Wagener's departure, and given that the Director was an ornithologist, the running of the bird collection was undertaken part-time by Ross McKenzie (Figure 15) as Associate Ornithologist. McKenzie, who served in this role from 1968 to 1972, lived at Clevedon, near Auckland (Brown 1990). He was an amateur ornithologist and keen member of the Ornithological Society, running the South Auckland branch for 19 years, and developing a particular interest in recording the wading birds of local estuaries. He lived with chronic pain and an artificial leg following injuries while serving with New Zealand forces in France during World War I. McKenzie published regularly in *Notornis* and wrote a book on where to watch New Zealand birds (McKenzie 1972).

Sylvia Mary Reed (1915-1981).—Sylvia Reed (Figure 16) succeeded McKenzie in 1972 and served as part-time Associate Ornithologist until her death (Sibson 1982). Like McKenzie she was a keen amateur

Figure 15. H. R. McKenzie during field-work banding New Zealand Dotterel chicks in the Auckland area, 1970s. Photographer unknown.

ornithologist and stalwart of the Ornithological Society. She ran the Society's Auckland branch for many years and established a bulletin, *Tara*, to record ornithological activity at the regional level. It appeared quarterly from 1976 to 1994. She published her field observations in *Notornis*, including reports of expeditions to islands of the Hauraki Gulf (Reed 1972, 1976) and Western Samoa (Reed 1980).

Reed was a founding member of the Miranda Naturalists' Trust that now runs a bird observatory in the Firth of Thames. She was keenly interested in conservation issues and had a particular concern for the New Zealand Dotterel (*Charadrius obscurus*), continuing work on that species initiated by Ross McKenzie. During her time at the Museum she greatly expanded the collection of bird skeletons, ensuring that the diverse seabirds that washed up on northern beaches were fully represented.

Taxidermy and preparation.—Leo J. Cappel (1933-), a Dutchman, was employed as Preparator from 1964 until 1982. He mounted some

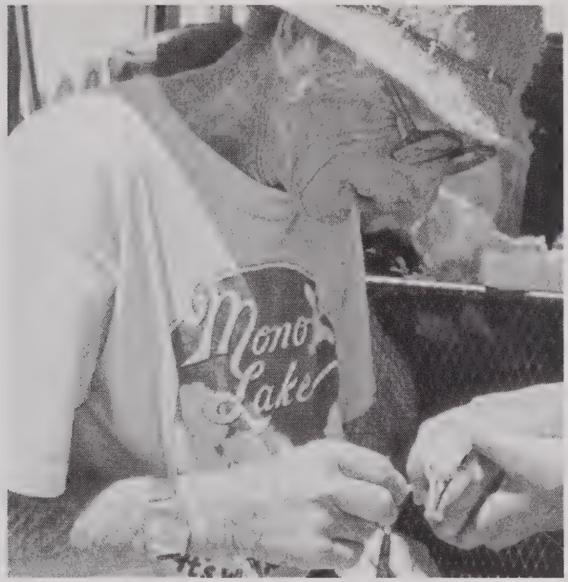

Figure 16. S. M. Reed banding New Zealand Dotterel at Mangawhai Heads, north of Auckland, January 1981. Photograph: J. Staniland.

birds, but was engaged mainly in installing dioramas and general displays, and was instrumental in creating exhibits for the 1972 Bird Hall (Figure 17). Preparation of study-skins was on a poor footing from 1958, when O'Brien left, until 1987, when Jenny Riley was appointed as a technician. During this period, the Museum had to engage outside commercial taxidermists to produce study-skins and they were seldom prepared or sexed to proper museum standards.

Second Bird Hall.—Although the extension to the 1929 building was completed in 1960, work did not begin on the new Bird Hall in the extension (first floor galleries south-east; Figure 18) until about 1969, with opening in 1972. Graham Turbott, then Director, planned the contents and wrote the labels. Leo Cappel helped develop the floor plan and produced the identification displays and dioramas. Windows in the gallery were covered, and illumination was by fluorescent lighting both general and within cases. Labels were hand-written by a staff artist, with main headings in cork lettering.

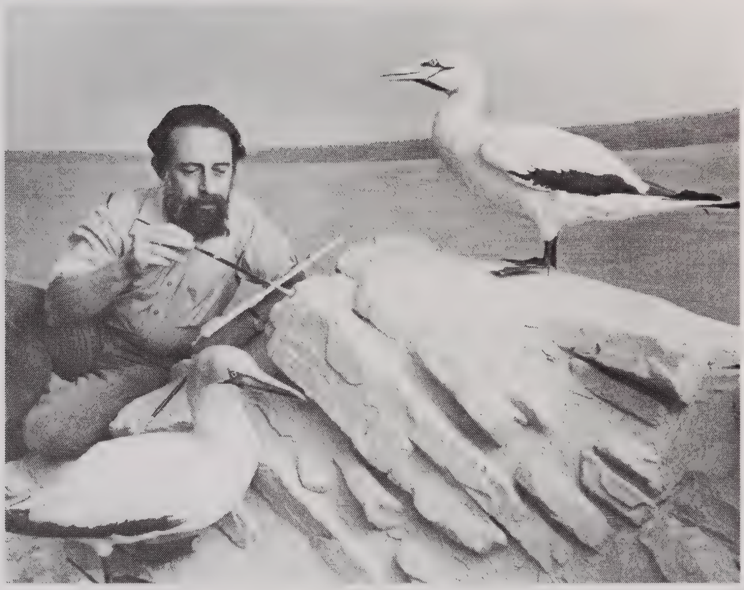

Figure 17. L. J. Cappel c. 1976, finishing the new gannet diorama in the Second Bird Hall. Photograph: N.Z. Herald collection, Auckland Museum.

The first item to be completed was the Wandering Albatross diorama at the entrance to the hall, installed by 1969-1970, and re-using birds from a 1933 display (Figure 13). The main part of the gallery (300 m^2) was opened to the public in April 1972, when six of the dioramas and three cases remained to be finished. The Little Barrier diorama was completed in December 1974, and the last diorama (gannet nesting group, Figure 17) in 1975-1976.

When complete, the 1972 Bird Hall contained some 470 mounted birds. There were four main sections dealing respectively with sea birds, forest birds, birds of town and country (plus extinct birds), and shore and swamp birds. For each of the main taxonomic groups (penguins, oceanic birds, shags, gulls and terns, ducks, waders) and habitats (forest, town and country, mountain and open country, freshwaters) there was an "identification series" comprising mounted examples of nearly every New Zealand species. These were grouped mostly on painted supports against plain painted backgrounds.

Spread throughout the hall were 12 dioramas both large and small. Most had fully domed backdrops. The hall's "feature diorama" showed

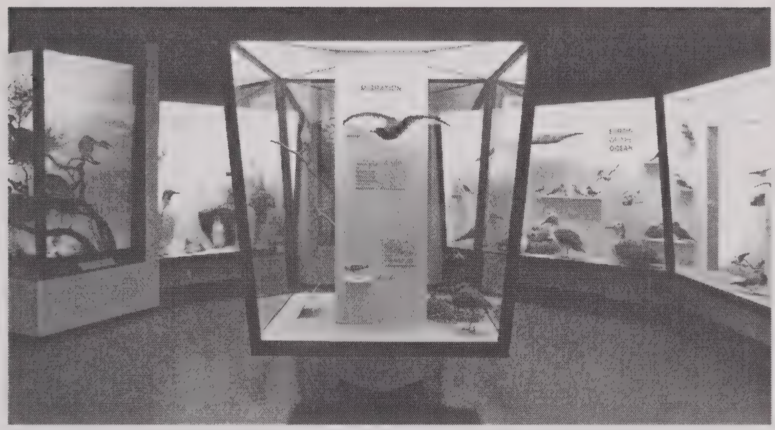

Figure 18. Displays in the Second Bird Hall, 1996. Photograph: K. Pfeiffer.

forest birds on a dry kauri ridge on Little Barrier Island. It comprised the carefully modelled ridge features, including representations of tree trunks and dense foliage, in front of a large painted plaster dome. Looking to the left past the birds and foliage could be seen the Hen and Chicken Islands on the horizon. In the wader "deep dome," the careful painting of the deep curved backdrop created the illusion, in a confined space, of a limitless horizon. An innovation by Cappel in the swamp scene inset was painted foliage on a fine gauze screen to create a middle distance and an illusory depth of field (Annual Report 1972-1973).

Most of the dioramas—albatross, Pied Shag, Spotted Shag, tern, kiwi, Kea, swamp scene inset, and swamp (inland waters) group—were modifications of "habitat groups" from the 1929 bird hall. The gannet colony, Little Barrier diorama, backdrop to the old moa reconstruction (Figure 19) and wader "deep dome" were new. Most of the mounted birds throughout the hall were reused from previous displays. At opening, the White-fronted Tern (*Sterna striata*) diorama had sound effects—tape-recorded bird calls activated by push-button. Sound was later added to the kiwi and Little Barrier dioramas.

The Bird Hall was broken up in 1996, and the gallery converted to botanical and ethnographic collection storage. The domes of many of the larger dioramas had been plastered against the walls and could not be moved. However, the albatross diorama at the gallery entrance survives as an example of the excellence in domed diorama-building

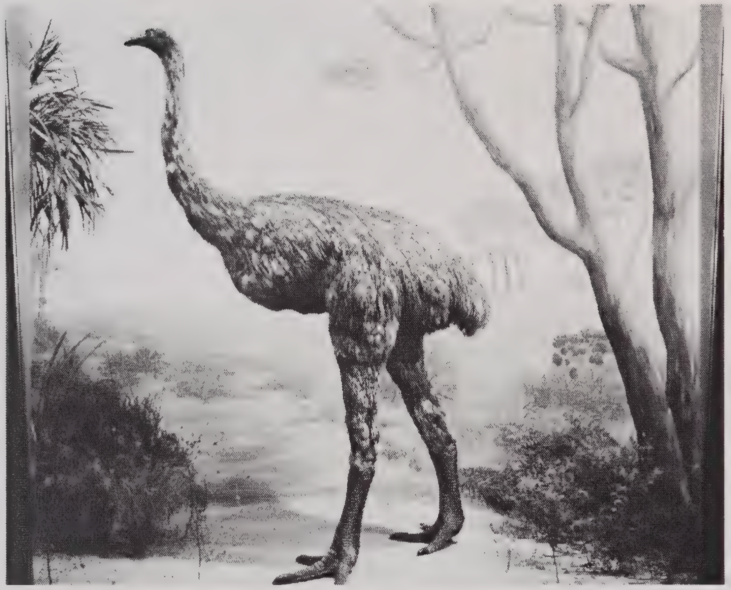

Figure 19. Reconstruction of a South Island Giant Moa (*Dinornis robustus*) in a domed diorama in the Second Bird Hall, 1972-1996. The model was built much earlier by L. T. Griffin using Emu feathers. Photograph: Auckland Museum.

achieved at Auckland Museum. From the 1960s until 1994, a Natural History Cross Gallery, linking east and west display spaces on the first floor of the 1960 extension, contained most of the Museum's mounted foreign birds.

Brian James Gill (1953-).—The bird collection was again managed full-time by a university-trained zoologist when I was appointed Curator of Land Vertebrates in 1982, following the death of Sylvia Reed. Initially I continued my previous ecological research-interests, with field studies of the Whitehead, a communally-breeding endemic passerine, on Little Barrier Island (McLean and Gill 1988, Gill and McLean 1992). Later I shifted emphasis to avian palaeontology (Gill 2000a, 2003), which was more closely linked to the collections. I have written several popular bird books (e.g., Gill and Martinson 1991, Gill and Moon 1999).

In 1987, Jenny Louise Riley (née Oats) was appointed part-time (one-third) Land Vertebrates Technician, producing well-prepared study-skins and bone preparations for the collection until 1996. She was succeeded from 1997 to 1999 by Maree O. E. Johnston. Ramola Prasad worked irregular part-time hours in support of the collection from 1996, and was made a full-time technician in 2005.

Temporary exhibitions.—Birds have been part of several short-term natural history exhibitions, and three special exhibitions were devoted exclusively to birds. In 1982 there was a brief showing of the original George Edward Lodge paintings from the recently published book on Lodge (Fleming 1982). In 1991-1992 the Museum staged "Kiwi & Moa: Flightless Wonders" as its summer exhibition. "Preen: New Zealand Birds & Prestigious Victorian Books" (2004) focussed on New Zealand birds illustrated by hand-coloured lithography in the books of John Gould and Walter Buller.

Collection storage.—The 1960 extension necessitated demolition of store-rooms on the ground floor at the rear of the 1929 building, and the bird collections were moved temporarily from there to first floor display halls at the front of the building. In due course the land vertebrates office and collection store were relocated to the first floor of the new curved administrative block at the rear of the building (south-east corner). The bird store was dimly lit by a few incandescent bulbs and calico curtains covered the windows to exclude light. The study-skins were stored in three styles of cabinet each with its own tray-size, the moa bones in wooden trays on wooden racks open to dust.

In 1990-1991, the first floor of the administration part of the 1960 extension was refurbished. The bird collection was moved temporarily to a closed-off portion of an exhibition gallery. The refurbished land vertebrates collection store was provided with generous fluorescent lighting, forced air-circulation, and internal insulated shutters or venetian blinds on the windows. It was in the same general location as before, but smaller, though its capacity was increased by use of compacting storage units. The 1960s skin cabinets from the old store were reused and new units built to match, thereby standardising on one size of skin-tray. In subsequent years the moa bones were cleaned, and stored in lidded boxes on open steel shelves.

Important recent accessions are a mounted Takahe presented by the Museum of New Zealand (1985), the W. R. McGregor collection of 360 study-skins (mainly Australian and African) received in 1992; 32 study-skins of Tongan birds salvaged by D. R. Rinke during conservation work and prepared by a foreign taxidermist visiting Tonga (received 1993-1994); and Holocene fossil bird bones collected at northern sand-dune sites by F. J. Brook and B. J. Gill (1993-1999).

David Robert Weatherley (1960-).—With a plan to redevelop the natural history galleries, the Museum in 1997 recruited David Weatherley from Britain as Preparator. Previously, he was with the North West Museums Service in northern England, where he had trained. David prepared numerous mounted birds for the new galleries and was responsible for many of the natural history models and installations. He cleaned and refurbished the albatross diorama, and since about 2000 has prepared study-skins and spread wings for the bird collection.

New natural history galleries.—In January 1999, four new natural history galleries opened in a complete refurbishment of the natural history floor. The galleries are themed according to time-sequences and habitats, with an Origins Gallery (origins of New Zealand's flora and fauna), Land Gallery (land habitats from alpine to lowland swamp), Oceans Gallery (marine habitats from shoreline to deep sea), and Human Impacts Gallery (recently replaced by a volcanoes exhibition). Birds are present throughout the new exhibits, in cases dealing with groups of species, in habitat dioramas open to view and suspended in flight.

Since 1994 the Museum has had a natural history centre for children (called "Weird and Wonderful") crammed with colourful and eye-catching specimens and exhibits, many of which can be viewed closely, and some of which may be touched. Birds are well represented, and currently it is the only area where introduced New Zealand birds and foreign birds are displayed.

THE BIRD COLLECTION

Statistics.—Auckland Museum's bird collection currently numbers 13,000 specimens, including 5200 study-skins, 3500 single eggs and clutches, 2500 contemporary and Holocene fossil bones, and 1300 mounts. The best-represented taxonomic groups are: ratites (1200 specimens), procellariiforms (1500), charadriiforms (1700), and passerines (3600). Most specimens (60%) are from New Zealand, but there are also 1600 from Europe and more than 700 from the south-west Pacific (including New Guinea). There are some 20 primary type specimens of birds and at least 40 secondary types (Gill 1983).

The oldest birds at Auckland Museum are study-skins of an American Tree Sparrow (*Spizella arborea*) collected at Philadelphia in 1843 and a Sedge Warbler (*Acrocephalus schoenobaenus*) collected in England in 1844, but obviously obtained by the Museum later. The oldest New Zealand bird specimens are fragments of moa eggshell collected by W. B. D. Mantell in 1847-1848 and 1852, but it is not known when the Museum received them.

None of the main field-collectors of birds in the collection, whether staff or outsiders, has individually collected more than 340 specimens. Such low numbers reflect an absence of sustained and systematic collecting of live birds by any contributors, and a reliance on salvage of dead birds, partly because of long-standing legal protection of New Zealand birds. The collection has grown opportunistically from the small contributions of many. Growth of the collection over time cannot be traced because the former species numbering system (see below) does not indicate the total number of registered specimens at given times.

The collection is used regularly by ornithological researchers, particularly university staff and post-graduate students, and staff of government agencies (e.g., Department of Conservation). Perhaps the most significant recent use has been by compilers of texts for the seven-volume *Handbook of Australian, New Zealand and Antarctic Birds* (1990-2006, Oxford University Press, Melbourne). Bird artists and illustrators who have used specimens in recent decades include Raymond Ching, Barry Cleavin, Ron Cometti, Bronwynne Cornish, Geoffrey Cox, Hamish Foote, Chris Gaskin, Dave Gunson, Paul Martinson, Derek Onley, and Elaine Power.

Registration and cataloguing.—The state of documentation of Auckland Museum's early birds owes much to the accuracy and meticulousness of T. F. Cheeseman, and few specimens were properly labelled before his appointment in 1874. Cheeseman labelled newly acquired specimens, but apparently did not number them until 1898, when he started a departmental register (the "Blue Book"; see Gill

1984) for specimens received between 1870 and 1917. A later register (the “Brown Book”), for New Zealand mammals and birds, was filled out by L. T. Griffin between 1919 and 1922, repeating many from the Blue Book. These registers had simple consecutive numbers.

In 1925-1926, L. T. Griffin re-catalogued the mounts and study-skins using 5 x 3 inch (12.7 x 7.6 cm) ruled index cards. Birds were given AV numbers (e.g., AV16.25 for the 25th specimen of the 16th species). Such species numbers did not anticipate taxonomic changes, and this system was abandoned in 1983-1984 in favour of a simple consecutive number. Birds now use the prefix LB which is unique within the Museum. The new system was applied to new accessions and, as time permitted, to old ones, the last of which are only now being renumbered in concert with electronic databasing.

In 1989-1990, a computerised catalogue was set up on a stand-alone personal computer using the DOS-based database software “Advanced Revelation” (Revelation Technologies Inc., USA). The records were moved in 2002 to a single museum-wide system using Windows-based “Collection” (Vernon Systems Ltd., Auckland).

Other ornithological resources at Auckland Museum.—The Curator’s office houses over 2000 offprints or copies of articles dealing with land vertebrates, mostly concerning New Zealand birds. The Library at Auckland Museum has a large collection of ornithological books and serials (see below under Ornithological Society). The Library houses several ornithological manuscript collections including those of G. A. Buddle, G. C. Munro, and R. B. Sibson. The Museum Library’s Pictorial Collection holds historical bird-related photographs including those by Buddle and J. C. McLean, and ornithological cine films including those taken by Falla and Turbott on expeditions.

ASSOCIATES AND ASSOCIATIONS

An early link between Auckland Museum and activities in the wider ornithological sphere was evident in the late 1800s. After the publication in 1888 of Sir Walter Buller’s *A History of the Birds of New Zealand*, Cheeseman evidently acted as agent for Buller (who lived in Wellington) for the distribution of copies to Auckland subscribers. Cheeseman’s letters of 1889 show that the process was complicated by an economic depression in the Colony which meant that some subscribers could not pay, or pay immediately, and by the loss of part of the print-run in a ship-wreck.

Another association was with New Zealand's great palaeontologist, biogeographer, and ornithologist, Sir Charles Fleming (1916-1987). As a child in Auckland in the early 1930s, Fleming was a founding member of Baden Powell's Auckland Museum Shell Club (McEwen 2005). Through Shell Club meetings at the Museum he met Falla and Archey, and as a young man, joined Auckland Museum expeditions, including the 1934 Three Kings Islands expedition, on the ketch *Will Watch*, that was organised by Falla. Falla and the Museum's taxidermist (Dover) taught Fleming how to make study-skins of birds. Later in life, Fleming presented Auckland Museum Library with books, including a set of Mathews' (1910-1927) *The Birds of Australia*, and he gave many skins from his personal collection to Auckland Museum. In 1971, he visited the Museum to deliver the inaugural Archey Lecture with the title "A New Zealand naturalist in his environment."

Ornithologists in the Museum's governance.—As well as ornithologists on the Museum staff, bird-enthusiasts have also been elected as members of the Museum's governing council. Arthur Thomas Pycroft (1875-1971, Figure 20) was an amateur naturalist with a special interest in birds. As a young man he provided bird observations to Buller, and gained a certain claim to fame by having eaten a Huia (*Heteralocha acutirostris*) when one was handed to him for taxidermy and he asked his landlady to cook the body (Sibson 1975b). Pycroft served on the Museum Council for 41 years and was its President in 1935 (Powell 1967:61). He was a good friend of the Museum as a collector and donor of birds over many years. Falla named Pycroft's Petrel (*Pterodroma pycrofti*) after him in 1933.

Sir Carrick Robertson (1879-1963) was a leading Auckland surgeon, and a supporter of scientific research, who served on the Museum Council for nearly 40 years (Powell 1967:61). He was a member of Gilbert Archey's "Moa Searching Committee," along with Sir Frank Mappin and A. T. Pycroft. This group of friends collected moa bones in 1930-1935 from parts of the northern North Island (Waikaremoana, Waitomo, and Karikari Peninsula) which were then remote and inaccessible. Frank Crossley Mappin (1884-1975) was a horticulturalist and philanthropist who served 30 years on the Museum Council (Stacpoole

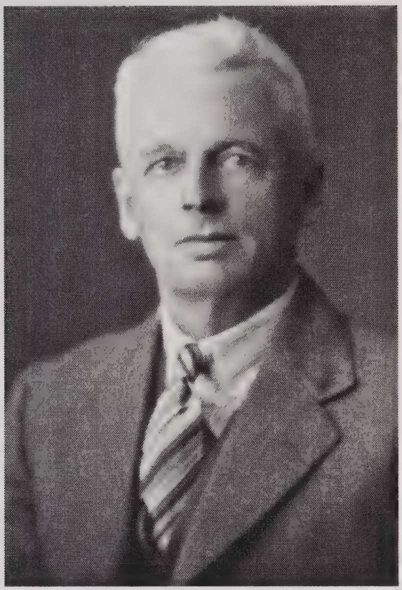

Figure 20. A. T. Pycroft, perhaps taken soon after World War II. Photograph: Auckland Museum.

1998). Archey named Mappin's Moa (*Pachyornis mappini*) in his honour.

Lieut.-Col. Arthur Robert Hughes (1900-1992) was a Councillor from 1960 to 1983, and President of the Museum Council in 1970-1973. He presented a large collection of Sri Lankan bird skins in the 1930s after a period of residence in Ceylon, and besides ornithology was interested in heraldry and book-plates (Thwaites 2001).

Richard Broadley Sibson (1911-1994) was a Classics master at an Auckland secondary school for many years, and one of the pioneers of modern amateur bird-watching in New Zealand (Bull and Lovegrove 1994, Gill 2000b). "Sib" was a founding member of the Ornithological Society of New Zealand and served it in various roles for much of his life. He supported ornithology at the Museum by donating specimens to the bird collection, and bird books to the Library, over a long period, and he was a member of the Museum's governing Council from 1960 to 1987. He co-authored an important field guide with Falla and Turbott

(Falla et al. 1966) and wrote other major bird books (e.g., Sibson 1972) and many papers for *Notornis*.

Michael John Taylor (1936-), before his retirement in 1996 a lecturer in physical chemistry at Auckland University, served on the Museum Council from 1978 to 1982. A long-time member of the Ornithological Society of New Zealand, Michael was organiser of the Auckland branch between 1983 and 1991, and has published in *Notornis*, most notably on shags (Dowding and Taylor 1987, Taylor 1987).

Volunteers.—Volunteers make a major contribution to activities at Auckland Museum. Most volunteers in the "Bird Department" have been amateur ornithologists and members of the Ornithological Society. Sylvia Reed was helped by Patricia Fooks, and I have had valuable and long-standing assistance from Nan Rothwell, Doug Booth, Michael Taylor, and Lyn Duff.

Ornithological Society.—The Ornithological Society of New Zealand (OSNZ) was founded in 1940 (Gill and Heather 1990), and has had various links to Auckland Museum. Bob Falla was instrumental in helping to establish it, but he had left the Museum by then. His successor Graham Turbott was a founding member, and served as Councillor (1953-1955), North Island Vice-president (1947-1949 and 1957-1958) and President (1949-1952). From 1980 to 1990, Turbott chaired a Checklist Committee that produced the Society's third *Checklist of the Birds of New Zealand* (Turbott 1990b). He was awarded the Society's Falla Memorial Award in 1988, and was elected a Fellow of the Society in 1997.

I was a member of the Turbott Checklist Committee from 1983 to 1990, and since 2001 I have chaired a new committee working on a fourth edition of the Society's *Checklist*. I have served also on the Society's governing council (1985-1991), Library Committee (1992-1995), and Rare Birds Committee (1998-2001).

Soon after its formation, the OSNZ began exchanging its journal *New Zealand Bird Notes* (later *Notornis*) for the bird journals of other societies and institutions around the world. This growing collection of ornithological serials has always been housed in the Auckland Museum Library, where, with the Museum's own strong collection of bird books, it forms perhaps the country's best ornithological library. A Society volunteer—currently Kathy Barrow, and before her, Anthea Goodwin—has come to the Museum approximately weekly to run the exchanges. The archives of the OSNZ are also held in the Museum Library.

From the 1960s, and possibly earlier, until 1998, a period when Museum managers saw value in supporting societies with kindred interests by providing a meeting venue at minimal cost, the Auckland branch of the OSNZ held its monthly evening meetings in the Museum.

CONCLUDING REMARKS

Auckland Museum has a history of more than a century and a half—almost as long as the history of modern government in New Zealand itself. Birds were important in the very first displays of the 1850s, and have continued ever since as a major element in the growth and development of the Museum's natural history collections and exhibits. There has been at least one staff member in charge of birds, and often researching and publishing in ornithology, almost continually since Cheeseman's appointment in 1874. The bird collection remains relatively small, partly through an absence of sustained and systematic collecting of live birds. However, with the three other bird collections in New Zealand, and 10 in Australia, Auckland Museum's birds are part of an Australasian network of complementary collections. In aggregate these collections number 500,000 specimens and are, appropriately, the internationally pre-eminent resource for the ornithology of the Australasian biogeographic zone.

ACKNOWLEDGEMENTS

I thank Michael Taylor and Graham Turbott for helpful comments on drafts of this article, Ramola Prasad and Shaun Higgins for help in sourcing and scanning images, and Diane Gordon for obtaining articles on inter-loan.

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3

A History of Ornithology at the Western Australian Museum

R. E. Johnstone[1]

ABSTRACT.—-A review of the 115 year (1892-2007) history of ornithology at the Western Australian Museum reveals an institution that was referred to in 1949 as "the most under-staffed and ill-equipped State Museum in the Commonwealth" to one that now has a distinguished record not only as a service museum but also in research, education, and conservation. Its research collections total about 45,000 specimens, are mainly of recent origin, and are a vital State, National, and International resource that provides material and information to hundreds of scientists, naturalists, and the general public annually. The succession of a few key ornithologists and biologists on staff starting with W. B. Alexander (1912-1919), L. Glauert (1921-1957), G. F. Mees (1958-1963), G. M. Storr (1962-1986), and R. E. Johnstone (1970-present) has had a major impact on the development of the Museums collections and of ornithology in Western Australia.

Although Western Australia had been visited by Europeans since early in the seventeenth century, little was learned of the birds before the beginning of European settlement in 1829. The most important reports of the early travellers and navigators are the anecdotal accounts of the Swan River by the Dutchman Willem de Vlamingh (1697); accounts by the Englishman William Dampier in 1688 and 1699; and observations and collections made by the French expeditions under the command of Nicolas Baudin (1801-1803) and Philip King (1818-1820). Dampier's notes contain references to several recognizable species and contain the first illustrations ever published of Australian birds.

On behalf of John Gould, the English ornithologist John Gilbert visited the Swan River Colony in 1839 and 1842-1843. He worked mainly around Perth but also made observations and collections in the Wongan Hills, Toodyay, and York districts; between Perth and Augusta; between Albany and Perth, and on the Houtman Abrolhos Islands.

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Gilbert's work along with observations and specimens from James Drummond, Johnston Drummond, G. F. Moore, L. C. Burges and other pioneers give us a fairly good picture of the avifauna of the south-west region in its pristine condition before settlement by Europeans in 1829.

What followed was generally a very bleak period of zoological activity the, "barren years 1843-1887" described by Serventy (1972). In 1887, an English ornithologist, Thomas Carter, arrived in Western Australia and did extensive fieldwork and collecting in the region of North West Cape.

A MUSEUM IS BORN

Within 30 years of settlement of the Swan River Colony, there were two museums in Western Australia, the Museum of the Swan River Mechanics Institute, founded by public subscription in 1860, and the Geological Museum at Fremantle started in 1881. In 1889 the contents of the Geological Museum were moved to the former Perth Gaol (a building that is still part of the Western Australian Museum) and Bernard H. Woodward, who was curator to the Geological Department, was appointed curator of this new museum in March 1891.

In June 1892 the Western Australian Government under John Forrest purchased the collection held by the Swan River Mechanics Institute and passed it over to of the Geological Museum. The collection was described by the *West Australian* newspaper (30 June 1892) as a varied one, including important geological collections,

> "a large collection of stuffed birds, an excellent collection of insects, a very fine British herbarium, small Australian animals and reptiles, a very fine collection of coins, several relics of earlier navigators, specimens of weapons, of different Australian and Asiatic tribes, native pottery, cloth, ornaments and wearing apparel, curious relics, several old books, models of ships, bridges and a number of other articles."

This was a collection that would form the nucleus of a State Museum; the word "geological" was dropped in 1895 from the title of the museum and thereafter it was known as the Perth Museum.

The establishment of a natural history section of the Perth Museum in 1892 under the curator Bernard H. Woodward was a significant event.

Woodward, who was also the curator of the Art Gallery, actively encouraged the building up of the Museum's zoological collections. With his position secure, Woodward embarked on an ambitious plan to expand collections and to develop new purpose-built galleries. Over the next 25 years, he built the Museum up from its humble geological beginnings to become a large and diverse institution.

THE RISE OF ORNITHOLOGY AT THE WESTERN AUSTRALIAN MUSEUM 1894-1910.

Woodward was anxious to greatly expand the zoological collections, especially Western Australian collections, and also keen to display foreign animals. In February 1894, the Museum employed Herman Franz Otto Lipfert as a taxidermist-collector (Figure 1). His role was also to set up displays of mammals, birds, and other exhibits in the pub-

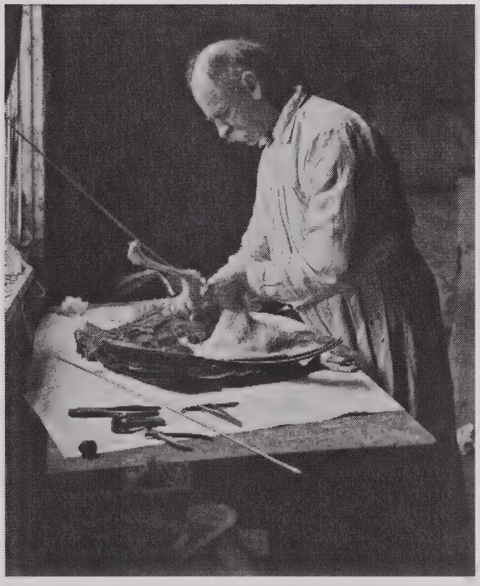

Figure 1. Otto Lipfert, Western Australian Museum during the mid-1930s (all photographs courtesy of the Western Australian Museum, unless otherwise credited).

lic galleries. In October-December of 1894, Lipfert made his first collecting expedition to the Houtman Abrolhos. In August-September of 1895, the Museum sent Lipfert to the Kojonup district where he met John Thomas Tunney (Figure 2) who Lipfert trained in recording and preparing specimens. Later that year Tunney wrote to Woodward offering his services as a collector for a proposed expedition to the Kimberley region. Tunney's first major expedition began in March 1896, and finished in January 1897, with the bulk of that time spent collecting in west Kimberley near Broome, Derby, and Fitzroy Crossing. Following this expedition Tunney spent six months recuperating at his family farm "Gracefield," near Kojonup and then accompanied Alexander Morton, from the Hobart Museum, to the Murchison region. In March 1898, he returned to the Kimberley and collected between Broome and Wyndham and returned in the first half of 1899. In the second half of that year he again visited the Murchison and as far east as Lake Darlot. In 1900, Tunney began collecting in the south-west, then went north to the Pilbara and in November he visited Barrow Island.

In June of 1900 Woodward completed a deal with Walter Rothschild enabling Tunney to remain employed by the Museum for a major expedition to the South Alligator River in the Northern Territory. As part of the deal, the mammal and bird specimens would be sent to Rothschild for identification and naming and the duplicates would be returned to the Western Australian Museum. Rothschild was a British collector who established a private natural history museum and financed collecting expeditions throughout the world. His collections are now part of the British Museum of Natural History. Apparently Woodward was short of funds and he would no doubt have been forced to terminate Tunney's contract had the agreement with Rothschild not been approved. Woodward also attempted to get Tunney on Brockman's Kimberley Exploring Expedition in 1901, but he was unsuccessful and Dr. House collected for the Museum.

While Tunney was in the Pilbara, Woodward advised him of the arrangements with Rothschild and he continued north, spending some six months in west Kimberley before travelling overland to Wyndham which he reached in June 1902. He then continued east to the South Alligator River and remained there until November 1903. From April 1901 to November 1903, John Tunney collected some 1300 birds jointly for the Western Australian and Tring museums. This collection was studied by Ernst Hartert (1905), who discovered in it two new species,

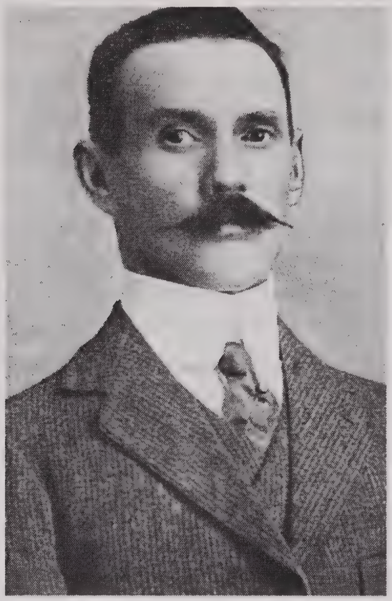

Figure 2. J. T. Tunney, photograph courtesy of *The Emu*.

Sandstone Shrike-thrush (*Colluricincla woodwardi*) and White-throated Grasswren (*Amytornis woodwardi*) and several new subspecies. Subsequently Gregory Mathews named many more subspecies and figured several of Tunney's skins in his *Birds of Australia* (Mathews 1910-1927). The collection was thus a most valuable one.

During much of this time Lipfert was kept busy at the Museum dealing with incoming specimens, especially with those sent in by Tunney, and working on the now famous diorama depicting a coastal swamp. The backdrop of the diorama was painted by the well-known artist and teacher, J. W. R. Linton in 1902. The ensuing value of this exhibition was emphasised by David Ride when interviewed by a journalist in 1966 (Renwick 1989) in connection with planned extensions for the building. Ride referred to the display in the course of outlining the future directions of the expanding museum:

> "a correctly assembled diorama can answer scores of questions to he who looks with a keen eye. Mr Otto Lipfert assembled a swamp diorama sixty years ago and it still fascinates children to

> discover birds eggs hidden in the reeds or the fatal struggle of a carpet snake and a sooty water rat."

Although now greatly outmoded, this diorama is still displayed in its original form as an example of the exhibitions and craftsmanship of the time. It was the first exhibition of this type assembled in the Museum and is a landmark in the evolution of museum displays.

In July 1908, Lipfert visited Rottnest Island and in September 1910, collected on Bernier and Dorre islands. An account of the visit, together with a list of birds recorded and some photographs were published by him in volume 1 of the *Records of the Western Australian Museum and Art Gallery*. These trips were followed in 1911 with a visit to the country between Cape Naturaliste and Cape Leeuwin. Lipfert also collected in the Stirling Range in November 1920, at Shark Bay in September 1923 with E. R. Bradshaw, and at Lake Yanchep in February 1924 with Dom Serventy. By far the longest and most arduous field expedition of his career was made between April 1930 and August 1931, when he accompanied A. W. Canning to recondition the wells along the Canning Stock Route between Wiluna and Halls Creek. Canning personally gave approval for Lipfert's attachment to the party. An arrangement was made with the South Australian Museum to share the cost and the collection. Some 200 bird skins were collected during this expedition, but it was one of great hardship with shortages of food. It took almost twice as long as intended. After this very arduous trip, Lipfert made only one other small collecting expedition to the Mogumber district in January 1932. He did, however, continue to record the bird life at Crawley, and in 1937 published in *Emu* a list of birds that had disappeared in the 40 years since he first began his observations there (Lipfert 1937).

Overall the history of the Museum here was one of continuous struggle and hardship against a background of two world wars and an economic depression. The Museum annual reports described the Museum as underfunded, understaffed, poorly housed, and badly equipped during Lipfert's 48 years as taxidermist-collector.

Systematic collecting by the Museum was greatly reduced after 1904 when the arrangements with Walter Rothschild ended. Tunney settled back on his farm near Kojonup, although he did participate in some short expeditions in the south-west. C. P. Conigrave (Woodward's assistant) participated in a joint collecting expedition with A. W. Milligan, Honorary Consulting Ornithologist to the Museum and one of the few competent taxonomists (member of the checklist committee of Royal Austalasian Ornithologists Union [RAOU]) in the State, to the Stirling Range in 1903. Conigrave also led a major expedition to the Houtman Abrolhos Islands in 1907.

The period between the late 1880s and the early 1900s was also a very active period for ornithological discovery with the arrival or visits of several overseas and eastern Australian ornithologists, notably in the south of the State, T. Carter, H. E. Hill, F. L. Whitlock, G. C. Shortridge, and A. C. Crossman, and in the Kimberley, T. H. Bowyer-Bower, K. Dahl, G. A. Keartland, F. M. House, J. P. Rogers, G. F. Hill, and R. Soderberg. From Carter in 1887 onwards there was a continuum of contact between ornithologists and the Museum.

During this period (1887-1910) overseas institutions carried out major collecting expeditions. Among these was Guy Chesterton (Chester) Shortridge from the British Museum of Natural History. Shortridge was critical of Woodward's practice of exchanging specimens to overseas museums and claimed that there was an incongruity in Western Australia being a valued hunting ground for British and European scientists, while local scientific institutions were left short of finances to carry out similar work. Before he returned to England, Shortridge recommended the appointment of a professional biologist to the Museum and also a palaeontologist to study fossil remains that had been found in caves in the south-west. In 1910, the task of studying the cave deposits was given to Ludwig Glauert, then employed by the Geological Survey. Glauert had studied geology at Sheffield, where he had been a demonstrator at University College. Overall Woodward was probably a good curator, but he relied on Otto Lipfert for animal identification and had a limited understanding of the value of research collections.

In 1897, the foundation stone of the Museum building facing James Street was laid and the first of the galleries in it was opened to the public in 1899. A second wing (formerly the Art Gallery of Western Australia) was added in 1905 on the Beaufort Street frontage. The Western Australian Museum and Art Gallery continued under the control of the Committee of the Victoria Public Library until 20 November 1911, when the *Public Library, Museum and Art Gallery of Western Australia Act* was proclaimed. The administration of the Museum remained under the executive control of Woodward until he retired in June 1916.

TOWARDS A MODERN ORNITHOLOGY.
W. B. ALEXANDER 1912-1919.

Shortridge had pointed out the need for a competent biologist in the Museum and in March 1912, Wilfred Backhouse Alexander (Figure 3) was appointed Assistant in Natural History. Alexander had taken his M.A. in the natural sciences at Cambridge and brought to the Museum a new level of professionalism. He was essentially the pioneer of modern ornithology at the Museum. He vigorously expanded its bird collections, organised museum displays along more modern lines, and stimulated scientific research and field studies. One of his first tasks in the Museum was to set up display cases illustrating themes including evolution, protective coloration, variation, and adaptation. He also recognised that extensive series of specimens of each species were needed for the rapidly developing field of geographic variation in museum research. Before this, it was the Museum's practice to exhibit all its specimens, except for "duplicates" which were held in "reserve." There is no doubt that Alexander converted the "duplicates" or "reserve" collection into a dynamic research tool for students and scientists.

There was a significant change in the catalogue system in 1912 that coincided with the appointment of Alexander. Each discipline was given its own catalogue, an implicit signal that curators had finally rid themselves of the creationist mentality (where all specimens were lumped into a single catalogue). Despite being hampered by a drastic reduction in funds, Alexander conducted a very active field program, participating in June 1912, on the Commonwealth-funded travelling expedition between Fremantle and Geraldton on the vessel *Endeavour*, adding many marine vertebrates to the Museum's collections. In November 1913, he visited the Houtman Abrolhos with the Percy Sladen Trust Expedition led by Professor W. J. Dakin from Sydney University. In the following year he motored to Eucla and back with W. C. Parkinson of the Carnegie Institution.

Overall his efforts to develop the collections were hampered by drastic reduction in the annual grant to the Museum. Basically his field activities were largely restricted to the Perth region and it was during these years that he built up his knowledge of the distribution and status of the birds of the Swan River district. In August-October 1914, he visited the eastern states, where he took part in the meetings of the British Association for the Advancement of Science. He made considerable collections in Queensland and during his return to Perth via Torres Strait and the north-west coast. On the retirement of B. H. Woodward, Director of the Museum and Art Gallery, Alexander was appointed Keeper of Biology.

With the Great War now raging, this was an extremely difficult time for Alexander. The Museum's annual grant was further reduced. Lipfert was employed only part-time and other staff had enlisted for military service. He was granted leave without pay in July 1916 to work in Melbourne for the newly formed Commonwealth Institute of Science and Industry, later to become the Commonwealth Scientific and Industrial Research Organisation (CSIRO). While in Melbourne he served as an Honorary Librarian to the RAOU and was elected to the committee that later produced the RAOU Official Checklist of Australian Birds.

At the end of March 1919, Alexander returned to Perth after an absence of nearly three years. By this stage Ludwig Glauert (Keeper of Geology and Ethnology and Acting Keeper of Biology) had enlisted in the Australian Imperial Force (AIF). For over a year there had been no professional officer at the Museum, apart from Lipfert, and Alexander was confronted with a huge backlog when he resumed his duties at the Museum. It is evident from his annual reports to the President of the Museum Board that he was irked by the limitations imposed and by the growing financial stringency of the institution. In his final report (for the year 1918-1919) he wrote:

> "I desire to emphasise my opinion that if we are to continue to accept specimens of value on behalf of the State, it is essential that sufficient funds should be provided to allow of suitable storage accommodation being made available. During the war the Museum has dispensed with the services of a carpenter, and no new shelves, cupboards or cabinets have been obtained. Unless some additional storage room is provided shortly it will be necessary to refuse to accept responsibility for the proper storage of specimens. Under present circumstances it is practically impossible for me to undertake any proper scientific study of the collec-

> tions received. Most of the specimens have to be put away with the hope that at some future date it may be possible to devote time to their study. In my opinion it should be recognised that the Museum is not carrying out its proper functions unless it is adding to the knowledge of the fauna and flora of the State by the publication of papers on these subjects. During the year I have published a description of a new marsupial and some notes on birds, as well as a paper on the history of zoology in the State. Most of the work was carried out in my own time. Until funds are available to allow of the appointment of an assistant biologist to relieve me of some of my routine duties, it will be impossible to find much time for what should be regarded as the proper work of a trained biologist in a museum."

Towards the end of 1919 Alexander left Perth for a vacation in England and in June 1920, while still in England he was appointed Biologist to the newly formed Commonwealth Prickly Pear Board.

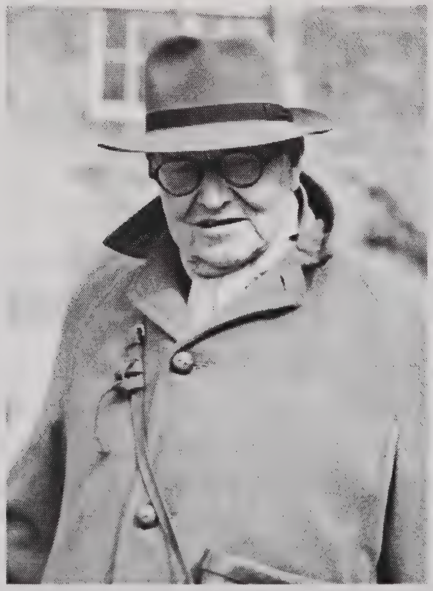

Figure 3. W. B. Alexander on the Farne Islands, May 1955. Photograph courtesy of Oxford University Library Services.

There is no doubt that Alexander made a wise decision to leave Perth as it was evident that the Museum at that stage did not have the resources to make the best use of his talents. There is also no doubt that if Woodward was pivotal in developing the bricks and mortar of this Museum, then Alexander certainly set it on the road to becoming a scientific institution. His influence and contributions to Western Australian science and natural history were significant. His methodology directly stimulated the youthful D. L. Serventy, who in turn helped train the present generation of Western Australian naturalists. His modern approach to museum displays and research collections was taken over by Ludwig Glauert, who succeeded him in the Biology Section of the Museum.

The funding of all museums in Australia was greatly reduced during the war years, and it took some time to recover to pre-war levels. Losing Alexander meant that the Museum lost its only qualified scientist and it thus lacked academically respected leadership for some years.

THE "MOST UNDER-STAFFED AND ILL-EQUIPPED MUSEUM IN THE COMMONWEALTH." L. GLAUERT ERA 1921-1957

On his return from World War I in 1920, Glauert was placed in charge of the Museum as Keeper of the Biological Collections. This title was changed to Curator in 1927 and to Director in 1954. Glauert's main interests in the earlier years were on fossil vertebrates in south-west caves but upon his return his research interests were transferred to scorpions, crustaceans, reptiles, and mammals. He did, however, work to some extent on birds. He continued W. B. Alexander's beach patrols that added a great deal of information on the seabirds visiting local seas. Glauert also described a new subspecies of Grass Owl (*Tyto longimembris maculosa*) (Glauert 1945) and, with C. F. H. Jenkins, provided the first scientific description of the eggs of the Banded Stilt (*Cladorhynchus leucocephalus*) from a colony discovered at Lake Grace in 1930 by Mrs. B. E. Cannon (Glauert 1930).

Glauert's influence and achievements were outstanding. He was a well-known public speaker and the daily press and radio stations sought his views on natural history. He also provided advice to university students and amateur naturalists, offering assistance and suggestions for projects. He started an educational program that included adult education with the Education Department that rapidly gained momentum and, in 1936, temporary assignment of teachers to the Museum was made permanent and the program continued until the Second World War. Glauert's educational programs were an important innovation and far ahead of those in other Australian museums. In 1929, Glauert gained an additional staff member when the Government approved the establishment of a cadetship for five years. C. F. H. Jenkins was appointed and in his memoirs he recalls the financial stringency of the period, a time when the Museum had no refrigerator to preserve animals, and when James Battye (General Secretary in charge of Library, Museum and Art Gallery) used to cut pencils and rubbers (erasers) into two and issued no

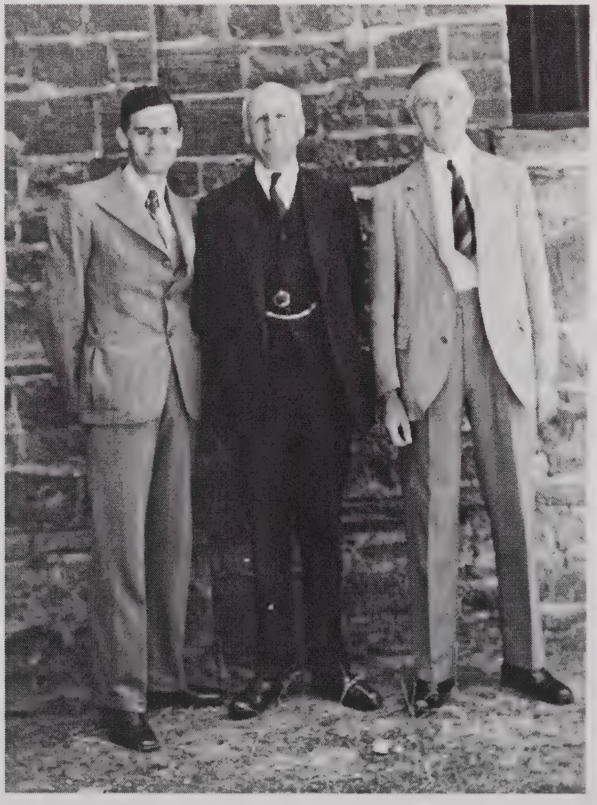

Figure 4. Left to right, D. L. Serventy, G. Mathews, and L. Glauert during the 1940s.

replacements unless the old worn-out stubs were produced. According to Dom Serventy, expenditure on the functional side of the Museum was £30 in 1928-1929, dropped to £19/19/5 in 1930-1931, and reached its lowest point of £13/3/9 in 1941-1942 (Figure 4).

There was no money for fieldwork and Glauert collected beach-washed specimens on local beaches and on Rottnest Island. In 1929 he spent six weeks collecting specimens on Landor Station on the Gascoyne River.

In 1933 Jenkins was offered a position in the Agriculture Department and Athol Douglas was appointed to replace him as apprentice to the Taxidermist. Lipfert however did not want an understudy so Douglas worked as a junior assistant. Douglas recalls that it was difficult to add to the collections because there were no facilities to cope with additions. The Museum, in and after the depression, "had absolutely nothing" and even the cost of boxes in which to pin insects was beyond its budget.

With the Second World War now raging, Glauert continued working on displays. In the Bird Gallery the cases were re-arranged to show themes including "Shore and Water Birds of the Swan River," "Birds of the Jarrah Forest," and "Birds of Rottnest." Douglas volunteered for active service at the commencement of hostilities. In 1941 Lipfert became ill; he died in June 1942. The war stifled many of Glauert's initiatives as he lacked staff and funds and the adult education in the Museum's program disappeared. With the Japanese bombing towns as far south as Onslow, the Government decided to recommission the wells along the Canning Stock Route in 1942-1944 to facilitate an exodus from the north in the event of an invasion. Kenneth Gordon Buller (Figure 5) an experienced taxidermist (trained by Lipfert) and collector joined the expedition as ornithologist and wireless operator. In 1942, Buller spent approximately four months (July-October) collecting on the southern parts of the Stock Route starting at Kalgoorlie and travelling via Wiluna as far as Well 22 (McKay Ranges). In the following year, April 1943 until March 1944, he collected on the northern portion of the Stock Route from Halls Creek south to Well 23. Buller's collection and observations provide base-line data for the avifauna of the Stock Route at a time when it was still occupied by Aboriginal communities. In April 1945, he travelled overland via Pithara, Mount Magnet, Nullagine, Marble Bar, La Grange, Broome, Derby, Noonkanbah, Fitzroy Crossing, Halls Creek, and Wyndham, arriving at Argyle Station in May. He collected along the Ord River until the middle of August, then returned to Perth by air. The bird skins from these expeditions are in the Western Australian Museum. In 1947 and 1948 Buller also collected 1037 skins for the American Museum of Natural History in the Murchison, Gascoyne, and Pilbara regions. Some of these were reported on by E. Mayr (1951). Glauert was from all accounts a difficult man to work with, often shouting at and bullying staff. Athol Douglas recalled Battye telling him that "if he could work with Glauert, he could work with the Devil." Lipfert hated Glauert and apparently refused to go to his office; meetings between the two were conducted on the steps of the Old Gaol, the half-way mark between their offices.

In 1948 the Museum education classes started by Glauert resumed under the control of A. Gardiner. During the mid-1950s the teacher in charge of the program was Vin Serventy, assisted by Harry Butler, later to become two of Australia's most famous naturalists.

Conditions at the Museum continued to be appalling. In 1949, a Museum committee chaired by Justice Wolff, stated the problems in

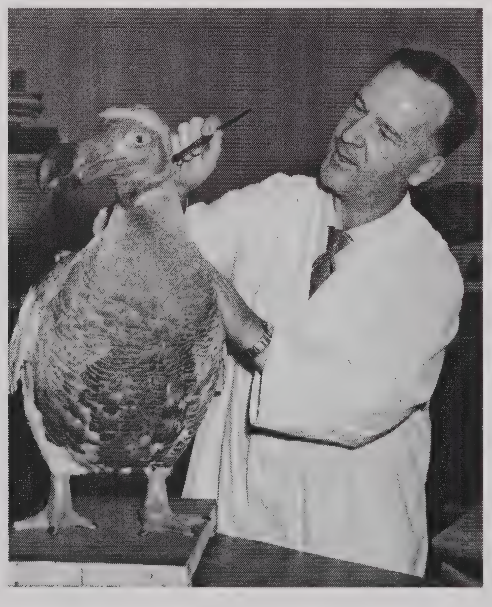

Figure 5. K. G. Buller, Western Australian Museum in 1968.

their report. The existing buildings had suffered from decades of neglect and were very inadequate, the galleries had only bare maintenance for 40 years and required renovations. The report concluded "This is the most under-staffed and ill-equipped State Museum in the Commonwealth. New Galleries and additional storage space are the most urgent needs. It cannot hold its place as a Museum unless these matters are rectified."

Reviewing Battye's death in 1954, the Board pointed out that the World Wars and the Depression had created enormous difficulties; the truth, however, was that under his management the Museum had been in one long depression.

THE PHOENIX BIRD RECOVERY ERA. W. D. L. RIDE 1957-1975

In 1957 Ludwig Glauert retired and brought to an end a period of 47 years of service in the Museum; and for 36 years he had controlled all of the collections. In July of 1957, at the age of 32, David Ride was appointed Museum Director. Ride had joined the British Army during the war and had carried out his tertiary studies at Hong Kong and Oxford where he had been a lecturer. At 32 he was the youngest museum director in Australia. Like Alexander he was young, bright, and energetic, fresh from a vigorous research school at Oxford on vertebrate biology. He immediately reviewed the state of the Museum and put forward recommendations for its development. Ride drew attention to the enormous deficiencies in the Museum, the poor state of the buildings, the state of the collections, the lack of staff, and the need for the Museum to play a role in environmental protection. He pointed out that the collections were inadequate because they lacked series of specimens. He estimated, for example, that only 10% of the State's bird species were adequately represented in the collections. With large tracts of land being cleared for agriculture (at a rate and on a scale un-paralleled elsewhere in the world up until that time), Ride argued that collecting was a matter of urgency, before agriculture and pastoral advances extinguished much of the local fauna and flora.

Ride was to begin a spectacular era of rejuvenation of research and exploration at the Museum, made possible by an increase in funding and in staff numbers. He initiated a series of major expeditions, including

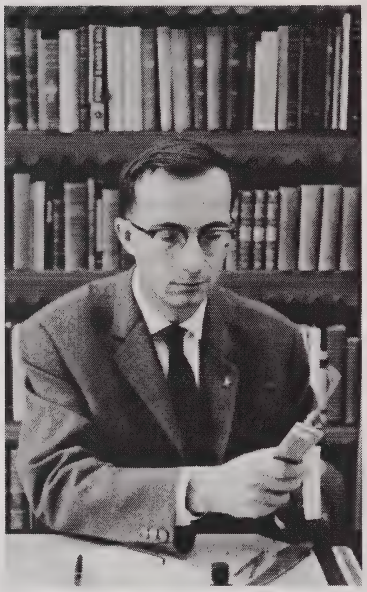

Figure 6. G. F. Mees, Leiden, 1963.

those to the Murchison and Hamersley ranges, and pushed for systematic zoological surveys to key faunal areas throughout the State.

G. F. Mees (1958-1963).—In 1958 Gerlof Mees (Figure 6) was appointed Curator of Vertebrates (birds, reptiles, amphibians and fishes) and remained in charge of the bird collections until 1963. During this period he carried out fieldwork mainly in the north-west and Kimberley and also made important collections on Christmas Island.

THE MODERN ERA (G. M. STORR—R. E. JOHNSTONE 1963-PRESENT).

Glen Milton Storr (1963-1986).—In 1962 Glen Storr (Figure 7) was appointed Assistant Curator of Vertebrates (birds, reptiles, amphibians, and fishes) and on the return of the Curator Gerlof Mees to the Netherlands in 1963, he was appointed Curator of Vertebrates. After the

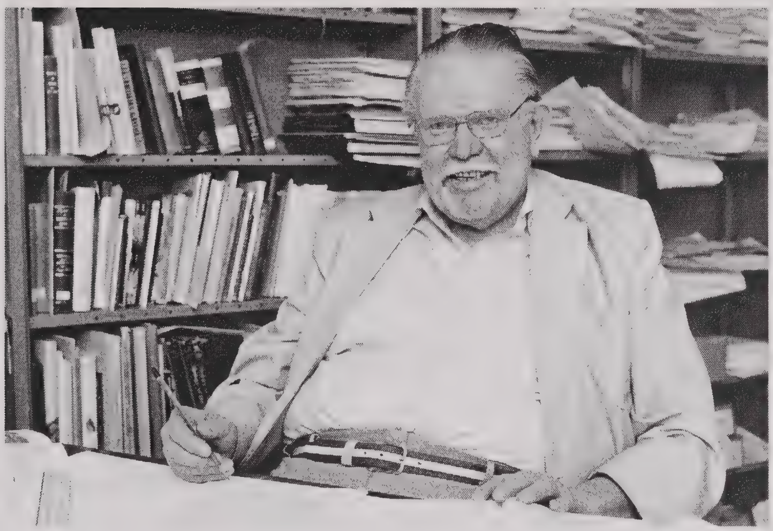

Figure 7. G. M. Storr, Western Australian Museum, 1986.

removal of the fish collection from his care in 1965, he became Curator of Ornithology and Herpetology, a post he held until his retirement in 1986.

It is difficult to overstate Storr's impact on both Australian ornithology and herpetology. Although a late starter in zoology (he was aged 40 when he completed his Ph.D. in 1960) his contribution to these fields is staggering. His life was a blend of two passions, birds and reptiles, generally working on reptiles by day and on birds by night. During the 1970s-1980s, in the Department of Ornithology and Herpetology, a department with three people (Glen Storr, Laurie Smith, and myself), there was a spectacular surge in collecting, in publications, and in the exploration of the State for both birds and reptiles. During this period the output of the department was indeed remarkable, over 300 scientific papers and books were published, three genera, 182 species, and over 50 subspecies of reptiles were described and the numerous revisions of the herptofauna formed the basis of a series of handbooks on the reptiles and frogs of Western Australia.

Storr's (and the department's) other major interest was avian faunistics. In the mid-1960s he began to search the literature and gather unpublished data from notebooks and diaries of many fieldworkers on

Northern Territory and Queensland birds. The data were compiled on species sheets and include notes covering distribution, ecological status, abundance, habitat preferences, breeding seasons, movements, specimens, and taxonomy. The Queensland data bank consists of about 6000 foolscap sheets with over 500,000 records on 562 species. His list of Northern Territory birds appeared in 1967 and was revised in 1977, and his Queensland list was first published in 1973 and was revised in 1984 (Storr 1984a). No species was included in these lists unless attested by a confirmed observation or by a specimen record and in either event that Storr was satisfied that the bird had been correctly identified. In his review of the Queensland list Shane Parker (1974) noted: "Although this is ostensibly a list of the birds of a single State, it is to my mind one of the most important works ever published on the distribution of Australian birds. Its value as a basis to systematics and as a source of problems for further investigation is enormous." This was certainly the case, as many researchers including Julian Ford, Shane Parker, Richard Schodde, and myself used both the list and the data sheets as a treasure trove of information from which to launch further studies. Julian Ford, an Honorary Associate of the Museum, was to leave an indelible mark on Australian ornithology with the quantity and quality of his research.

Ronald Eric Johnstone (1970-present; Figure 8).—When I joined the department in February 1970, we began a massive resurgence in fieldwork throughout the State beginning in the Kimberley, which shares with the "Top End" of the Northern Territory and far north-western Queensland a distinctive avifauna. Because of ill health, Storr did not go into the field after 1970 but helped plan and sponsor many expeditions. Our plan was to work systematically through the State starting with the Kimberley followed by the Pilbara, Gascoyne, north-eastern interior, mid-eastern interior, south-eastern interior, Eucla region, and finally the south-west to greatly improve our knowledge of the avifauna and our collections. In the Kimberley, for example, major expeditions were carried out by the Museum, alone or in collaboration with the Department of Fisheries and Wildlife, to Coulomb Point in June-July 1971, Lake Argyle October 1971 and January-February 1972, Bonaparte Archipelago May-June 1972 and June-July 1973, Mitchell Plateau January-February 1973 and October-November 1976, Dampierland June 1974 and April-May 1977, Prince Regent River Reserve August 1974, east and west Kimberley June-July 1975 and

October-November 1977, south-east Kimberley June-July 1975, Yampi Peninsula August-September 1975, Drysdale River National Park August 1975, Edgar Ranges August 1976, Lawley River 1976, Cambridge Gulf 1982, and Kimberley rainforest surveys 1987 and 1989. Our focus was then on other parts of the State including the Pilbara, Gascoyne, and deserts. Also noteworthy is that during the course of these regional surveys we proposed names for numerous geographical features (especially unnamed islands) that were approved by the Department of Land Administration. Many of these were named after birds or important ornithologists and herpetologists for example, in the Kimberley—Rail Creek, Mertens Falls, Glauert Lagoon, and Storr Island; in the Houtman Abrolhos—Hall, Saville-Kent, Dakin, Gilbert, Alexander, Serventy, Gibson, Campbell, Bynoe, Holms, Stokes,

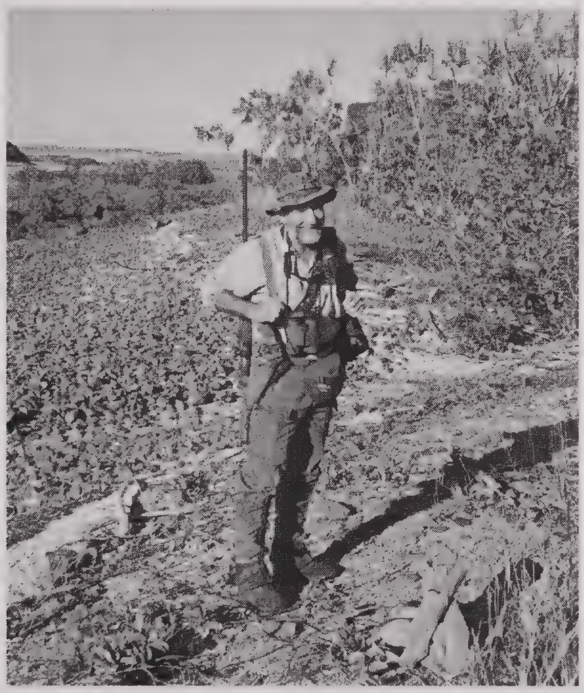

Figure 8. R. E. Johnstone collecting on Glauert Island, West Kimberley, 2005. Photograph by R. How.

Shearwater, and Crake islands; and in the Archipelago of the Recherche—Godman, Tunney, Hull, Gould, Ford, and Skink islands.

The first of the 10 regional avifaunas covering the State, *Birds of the Kimberley Division, Western Australia* was published in 1980 (Storr 1980), followed by North-eastern Interior (Storr 1981), Pilbara (Storr 1984b), Gascoyne (Storr 1985a), Mid-eastern Interior (Storr 1985b), South-eastern Interior (Storr 1986), Houtman Abrolhos (Storr, Johnstone and Griffin 1986), Eucla Division (Storr 1987), Swan Coastal Plain and adjacent seas and islands (Storr and Johnstone 1988) and finally the South-west Division that I completed after Storr's death in 1990 (Storr 1991).

The Field Guide to the Birds of Western Australia (Storr and Johnstone 1979) was published in 1979, and a second edition published in 1985 was followed by seven reprintings.

Our department was also fortunate during the 1970s and 80s in having Julian Ford as an Honorary Associate. He was one of the last of the classical explorer-naturalists, personally collecting thousands of specimens for the Western Australian Museum, especially from the desert regions. His scholarly publications on speciation and hybrid zones in Australian birds, especially on quail-thrush (Ford 1970a), fig-birds (Ford 1975), Variegated Fairy-wrens (*Malurus lamberti*), the ground-thrush complex (*Zoothera*), Varied Sittella (*Daphoenositta chrysoptera*), and the Black-faced Woodswallow (*Artamus cinereus*) (Ford 1978) ensured him a significant place in Australian ornithology (e.g., Ford 1970b, 1974, Ford and Johnstone 1991).

Special mention is due here of the outstanding contribution to the work of the Western Australian Museum and to natural history generally, of Harry Butler CBE (Commander of the British Empire), CitWA (Western Australian Citizen of the Year Award), a highly skilled, collector, preparator, and field naturalist. In 1968 Harry was a member of the British Museum's Harold Hall Australian Expeditions to the Kimberley which rediscovered the Black Grasswren (*Amytornis housei*) which had not been seen since early in the century. During the 1970s and 1980s Harry made numerous expeditions to remote parts of the Kimberley and Pilbara including Dampierland, the Ord River, Mitchell Plateau, and the north-west coast. In the winter and spring of 1975 he spent three months collecting and observing birds for the Western Australian Museum in the far south-east Kimberley and on the Yampi Peninsula. This work was especially important in determining the southern limits of many

Kimberley species and the northern limits of desert birds. His extensive collections are mainly lodged in the Western Australian Museum, but he also made collections for the American Museum of Natural History, New York, on the Mitchell Plateau and on the Canning Stock Route. Harry and his wife Maggie have also been extremely generous benefactors to the Western Australian Museum, providing financial support for publications and field expeditions throughout Australia through the Butler Trust established in 1976.

With Glen Storr's retirement in 1986, the department was essentially divided and I assumed responsibility for Ornithology and Laurie Smith for Herpetology. I was promoted to Assistant Curator in 1996 and Curator in January 2001. From the day I joined the Museum in February 1970, it was evident that the day-to-day running of the department has always been beyond the scope of the personnel in it, especially during the past two decades where I have been the only staff member in ornithology. To counter this I have relied on the help of non-salaried workers including Research Associates J. C. Darnell and J. Long, Honorary Associates D. L. Serventy, J. R. Ford, N. Kolichis, G. Lodge, and volunteers, especially C. Johnstone, H. Darnell, P. Stone, K. Sarti, T. Bush, and S. Gomez. Nick Kolichis and Geoff Lodge have also provided generous financial support for many departmental activities. In December 2004, Claire Stevenson was appointed as a Technical Officer in the Department of Terrestrial Vertebrates and provides technical support for the mammal, reptile, and bird sections.

Collections, Research and Education.—At the time of my appointment in 1970, the ornithological collections comprised about 9800 specimens. Our collections now contain over 45,000 and during my tenure I have contributed significantly to the reptile and mammal collections. By any standards, these collections are still in their infancy. However, the ornithological collections are modern with over 60% collected in the past 30 years. Overall, I have attempted to continue the historical strengths of the department, and research projects and investigations mainly focused on distribution, status, breeding biology, and taxonomy of Australian and Indonesian birds. To date I have published over 120 scientific papers and books including papers dealing with the taxonomic status of the Dusky (*Gerygone tenebrosa*) and Large-billed (*G. magnirostris*) gerygones (Johnstone 1975); geographic variation in Silver Gulls (*Larus novaehollandiae*) (Johnstone 1982); a series of papers dealing with the distribution, ecology and taxonomy of pigeons including the Rose-crowned Fruit-Dove (*Ptilinopus regina*) and Torres Strait Pigeon (*Ducula bicolor spilorrhoa*) (Johnstone 1981a), the Partridge (*Geophaps smithii*) and Spinifex (*G. plumifera*) pigeons (Johnstone 1981b), the Peaceful Dove (*Geopelia placida*) (Johnstone 1992); descriptions of several new subspecies from Western Australia and eastern Indonesia including a new Mangrove Kingfisher (*Todiramphus chloris pilbara*) (Johnstone 1983), a new Sunda Bush-warbler (*Cettia vulcania kolichisi*), and Boobook Owl (*Ninox novaeseelandiae rotiensis*) (Johnstone and Darnell 1997a,b); island and regional avifaunas, for example, North Fisherman Island (Johnstone 1978), Six Mile Island (Johnstone and Smith 1987), Drysdale River National Park (Johnstone et al. 1977), Mitchell Plateau (Johnstone and Smith 1981), Dampier Peninsula (Johnstone 1983); monographs on mangroves and mangrove birds (Johnstone 1990); rainforest birds (Johnstone and Burbidge 1991); a series of papers dealing with Indonesian (Lesser Sunda) islands, for example Sumbawa, Moyo, and Sangeang islands (Johnstone et al. 1996), Roti Island (Johnstone and Jepson 1996), and Gag Island (Johnstone 2006). Seven major expeditions were carried out to eastern Indonesia between 1988 and 1997 designed to allow an evaluation of the bird biogeography of the region including the Indo-Australian region. Between 1992 and 2006, most of my energy went into compiling the two volume *Handbook of Western Australian Birds. Volume 1 Non-passerines* was published in 1998 and *Volume 2 Passerines* in 2004 (Figure 9). In these handbooks each species is comprehensively treated with information on morphology, distribution, status, habitat preferences, migration, nests, eggs, food, and behaviour. Distribution maps and the species accounts were compiled from a data bank with over two million records. Also noteworthy in Volume 2 is my collaboration with John Darnell to produce appendices covering the birds of Christmas Island and Cocos-Keeling Islands. The end result is that Western Australia and Christmas Island, Cocos-Keeling, and Ashmore Reef have a detailed and accurate account of their avifauna. Another noteworthy publication is the *Checklist of the birds of Western Australia* (Johnstone 2001) used by State Government Departments.

A major recent research initiative is looking at the distribution, status, conservation, and breeding biology of four endemic Western Australian cockatoos (Forest Red-tailed Black-Cockatoo *Calyptorhynchus banksii naso*, Baudin's Black-Cockatoo *C. baudinii*,

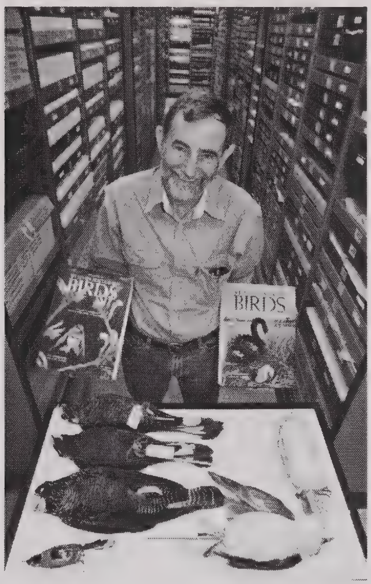

Figure 9. R. E. Johnstone, Western Australian Museum, Collections and Research Centre, Welshpool, 2005.

Carnaby's Black-Cockatoo *C. latirostris* and the Western Corella *Cacatua pastinator*). A grant from the Water Corporation has allowed a full-time Research Officer, Tony Kirkby, to be employed on this project. A public program, "Cockatoo Care" initiated by the Museum and the Water Corporation, has had huge success in raising awareness and increasing public support for the plight of the State's endangered cockatoos. The web site receives about 300,000 hits per year and continues to be an excellent mechanism for directing public interest and enquiries. Studies on birds of the Ord River basin, birds of the Pilbara region (a collaborative project with Department of Environment and Conservation), and several new field guides are in preparation. I also answer nearly all enquiries dealing with ornithology (over 3000 per year) and provide advice and information to other museum departments, the general public, government departments, and other organisations.

Displays.—In 1994 with the help of Kirsten Tullis (of the Museum's Exhibition and Design Department) we developed a new bird gallery in the Beaufort Street wing of the Museum. This exhibit illustrates avian biodiversity in the Perth region, from the Darling Scarp across the Swan Coastal Plain to the Indian Ocean. I also produced an information booklet covering this gallery.

CONCLUSION

Considering the early years of neglect (mainly between 1912 and the 1960s), the Museum as a whole and the Department of Ornithology and Herpetology in particular, have been very dynamic and productive. This is especially so during the past 40 years. Our most enduring legacies are the research collections and our publications. Our role to investigate, document, and showcase the diversity of the Western Australian and Indian Ocean region avifauna and also as a repository of reference material, is more important today than it was 100 years ago. Apart from our traditional roles of taxonomy and systematics there is an urgent need to continue to map species ranges, monitor changes in populations, and to identify and characterise threatened habitats and their avifaunas.

As extinctions occur at a rate unsurpassed in recent history, I would hope that government administrations would acknowledge the importance to society of a vibrant museum, ensuring that representative examples of our fauna are preserved for reference, the advancement of knowledge, and enjoyment by succeeding generations.

ACKNOWLEDGEMENTS

I thank our Head Librarian, Margaret Triffitt, for help in locating photographs and unpublished notes on the Western Australian Museum's early history, especially those of I. M. Crawford that were critical in establishing details of early workers. John Darnell and Kim Sarti provided useful suggestions for improving the paper. I am also grateful to William (Ted) Davis for not only his comments on the manuscript but for his encouragement and patience throughout the preparation of this paper.

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APPENDIX A

BUILDINGS

The Western Australian Museum Perth complex contains a very diverse collection of buildings ranging from those specifically designed for museum purposes such as the Jubilee and Francis Street buildings to the old Gaol. Extensive development and renovations have taken place since its doors opened in 1891. After the closure of the old Perth Gaol, built in 1854-1855, in 1895, the building was modified to house the Western Australian Museum. Three tiers of cells were demolished and the roof lowered. The overall plan was to build a north and south extension to the old Gaol building, one to house the museum and the other the library. The northern wing was built in 1895 but the southern wing was never added. It was decided, however, to construct a new wing fronting James Street to celebrate Queen Victoria's 60th year of rule. It was designed by John Grainger in Victorian Byzantine style. The arches and supporting columns are of Rottnest Island sandstone, the foundation and basement are of Cottesloe sandstone, the granite for the steps was from Meckering, the red bricks produced locally and the original roof was slate. The open arcade on the south side was enclosed for

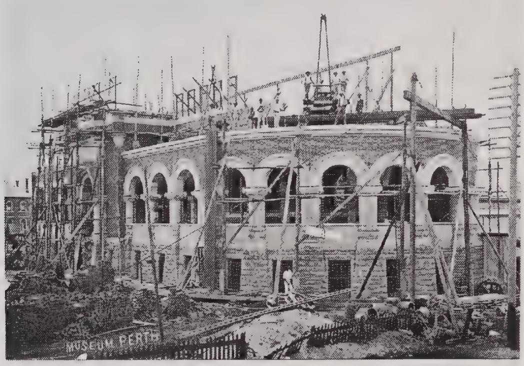

Figure 10. Jubilee wing of the Western Australian Museum under construction, late 1890s.

office and laboratory space in 1954. Building of the Jubilee wing commenced in 1897 and the library moved into the basement before construction was completed. It later moved into the ground floor. The Museum moved into this building in 1898, occupying offices in the basement and the first floor display area (Figures 10, 11, 12). The Library moved into Hackett Hall in 1903. The Francis Street building was to be the first stage of the development of a "Cultural Centre" that

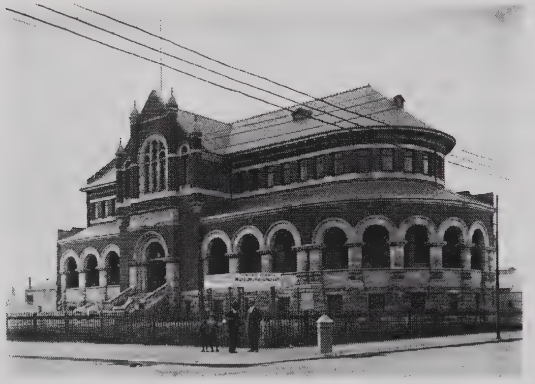

Figure 11. Jubilee wing of the Western Australian Museum, 1903.

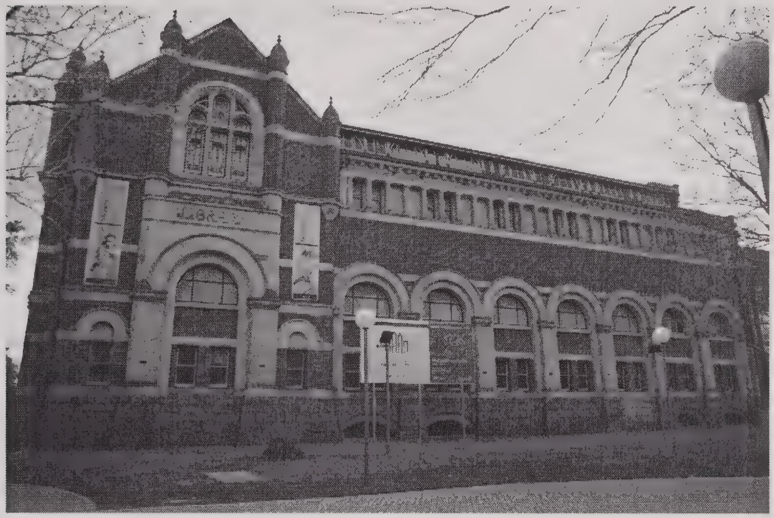

Figure 12. Hackett Hall of the Western Australian Museum.

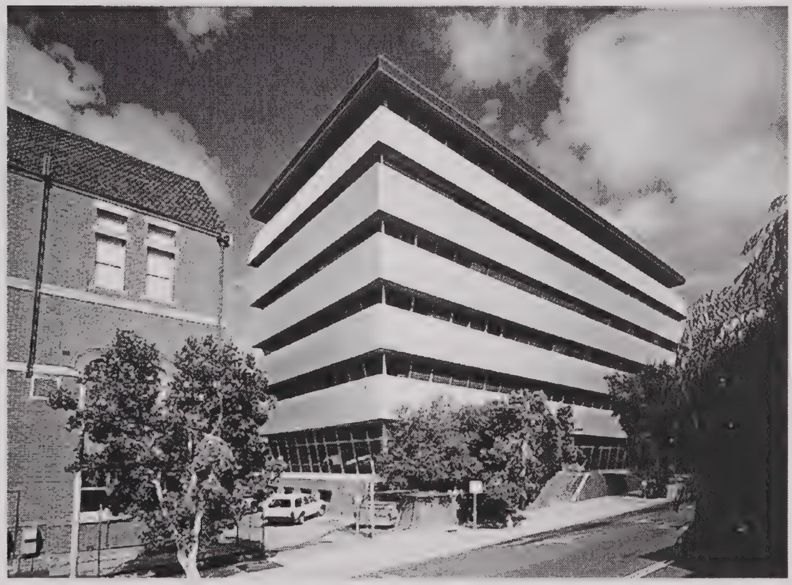

Figure 13. Francis Street complex of the Western Australian Museum, 1980.

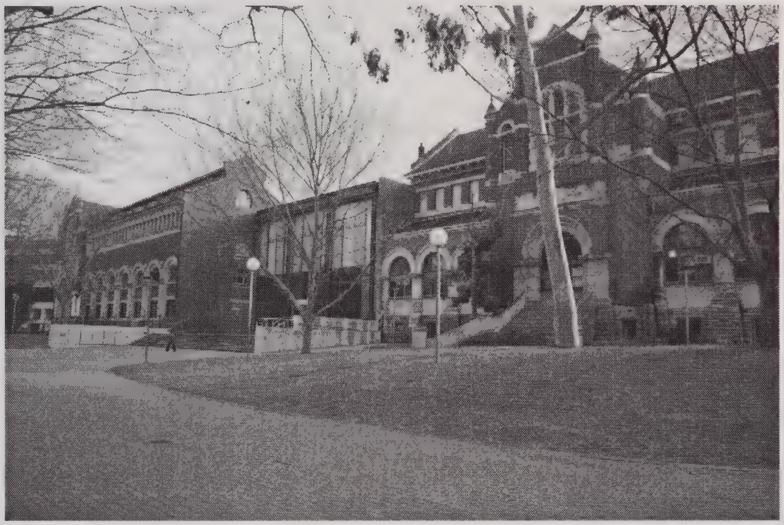

Figure 14. Left to right, Hackett Hall, link building, and Jubilee wing, 2006. Photograph by Ron Johnstone.

was to include a new art gallery and a new library. The Francis Street building was to house the museum's administration, curatorial staff, and collections. It was the first "modern," purpose-built museum building in Australia and was described as cutting edge. The specimen storage areas had power operated banks of moveable shelves and inbuilt, temperature, humidity, and fire controls. Building began in 1969 using the "lift slab" process where the floor slabs were poured on the ground then jacked-up the columns into position. Staff moved into the building in 1971 (Figure 13). In 1999 the glass "Link Building" was constructed to link Hackett Hall and the Jubilee wing (Figure 14). In 2004-2005 with the Francis Street building condemned due to asbestos in the columns, the staff and collections were moved to a new collection and research centre in Welshpool.

APPENDIX B.

COLLECTORS AND CONTRIBUTORS OF SIGNIFICANCE TO THE WESTERN AUSTRALIAN MUSEUM.

Alexander, Wilfred Backhouse (1885-1965). Assistant in natural history at the Museum 1912-1915.

Allen, Terry Charles (1943-). Oologist and naturalist who donated notes and specimens to the Museum.

Bannister, John Leonard (1937-). Director of the Museum 1975-1992.

Berry, Patrick Fleetwood (1944-). Head of Division of Natural Science 1980-2003.

Buller, Kenneth Gordon (1915-1995). Collector and taxidermist .

Bush, Tony Edward (1942-). Oologist and naturalist who has donated many specimens to the Museum.

Butler, William Henry (Harry), CBE , CitWA (1930-). Honorary Associate, collector, naturalist, author, television presenter, and generous benefactor.

Carnaby, Ivan Clarence (1908-1974). Oologist and naturalist, donated specimens and notes. He is commemorated by Carnaby's Cockatoo *Calyptorhynchus latirostris*.

Carter, Thomas (1863-1931). Collector who worked in the Pilbara, Gascoyne and south-west regions. Many of his specimens are in the Museum.

Charter, J. Harry J. Assistant to G. C. Shortridge (1880-1949). Collected specimens in the south-west that are lodged in the Western Australian and South Australian Museums.

Coate, Kevin Howard (1936-). Geologist-naturalist who has donated specimens and notes.

Conigrave, Charles Price (1882-1962). A senior assistant.

Crossman, Alan Fairfax. Donated specimens to the Museum in early 1900s.

Darnell, Hazel (1935-). Museum volunteer who has assisted with Museum projects and publications.

Darnell, John Charles (1936-). Research Associate and contributor to *Handbook of Western Australian Birds*; also skilled illustrator and expert on Asian birds.

Dell, John (1943-). Senior Technical Officer and researcher, Department of Vertebrate Biogeography and Ecology at the Museum (1971-2000).

Douglas, Athol Mardon (1915-2006). Entomologist at the Museum, also collected some bird specimens.

Ford, Julian Ralph (1932-1986). Honorary Associate, naturalist, and skilled collector who donated many specimens to the Western Australian Museum.

Gibson, Charles George (1878-1937). Geologist to F. S. Brockman's Expedition to north-west Kimberley in 1901. Donated some specimens.

Glauert, Ludwig (1897-1963). Appointed to staff of the Museum in 1910, on his return from World War I in 1920 was appointed keeper of the Biological Collections; this title was altered to Curator in 1927 and he was Director from 1954-1957.

Griffin, Phillip (1964-). Technical Assistant in the Department of Ornithology and Herpetology (1979-81).

Howard, Max (1946-). Naturalist, photographer and Museum volunteer on the Cockatoo Care Project in 2006.

Jenkins, Clee Francis Howard (1908-1997). Cadet at the Museum from 1929-1933, entomologist, naturalist, and broadcaster.

Johnstone, Christine (1953-). Museum volunteer who has assisted with projects including *Handbook of Western Australian Birds* and Cockatoo Care.

Johnstone, Ronald Eric (1949-). Joined the Department of Ornithology and Herpetology in February 1970, promoted to Senior Technical Officer in 1985, Assistant Curator in 1996, and Curator of Ornithology 2001 to present.

Kenneally, Kevin Francis (1945-). Botanist, general naturalist, and Museum Associate.

Kirkby, Anthony Thomas (1958-). Naturalist-ornithologist. Field Research Officer working on cockatoos for the Cockatoo Care Program 2001-2007 and on other projects including the Wungong Catchment project in the south-west.

Kolichis, Nicholas (1945-). Oologist, collector, and generous benefactor to Department of Ornithology, especially for field expeditions and publications including *Handbook of Western Australian Birds*.

Lodge, Geoffrey Allan (1933-). Oologist and collector who has donated many specimens to the Museum and participated in numerous field expeditions.

Long, John Latham (1932-2000). Ornithologist and Honorary Associate of the Museum.

Mees, Gerloff Fokko (1926-). Curator of Vertebrates, 1958-1963, collected specimens in north-west and Kimberley regions also on Christmas Island.

Milligan, Alexander William (1858-1921). Honorary Consultant Ornithologist from 1901-1908.

Morcombe, Michael (1938-). Naturalist, author, and skilled photographer who has assisted the Museum with notes and photographs for publications.

Orton, Clarence Leonard Efremont (1883-1965). Oologist whose collection was presented to the Museum.

Pink, Robert Lance (1941-1993). Naturalist who worked extensively in the Gascoyne region.

Ride, William David Lindsay (1926-). Director of the Western Australian Museum 1957-1975.

Robinson, Angus Hargreaves (1907-1973). Naturalist and collector, his oological collection and large series of magpie specimens were donated to the Museum.

Rogers, John Porter (1873-1941). Collected specimens for Robert Hall and Gregory Mathews in northern Australia in early 1900s. Some of his specimens are in the Museum.

Sarti, Donald Kimberley (1947-). Museum volunteer working mainly on database management and studies on black cockatoos.

Sedgwick, Eric Harry (1909-). Ornithologist who donated specimens and notes to the Museum.

Serventy, Dominic Louis (1904-1988). Fellow of the Museum, also his bird skin collection and journals were presented to the Museum.

Smith, Joseph A. (1934-). Generous benefactor to Department of Ornithology and Herpetology.

Smith, Lawrence Alec (1944-). Joined the Museum as Assistant to W. D. L. Ride in 1960, worked as a Technical Assistant, Technical Officer, Assistant Curator, and Acting Curator of

Herpetology in Department of Ornithology and Herpetology, and Terrestrial Vertebrates from 1962-2001.

Stevenson, Claire Anne (1979-). Joined the Museum as a Technical Officer in Department of Terrestrial Vertebrates in December 2004.

Stone, Philip (1932-). Oologist who has donated specimens to the Museum, assisted with publications including egg plates in *Handbook of Western Australian Birds* and with field projects.

Storr, Glen Milton (1921-1990). Curator of Ornithology and Herpetology 1963-1986.

Thompson, Martin Harburn (1951-). Skilled scientific illustrator and taxidermist employed in Department of Aboriginal Sites 1971-1974 and Department of Exhibition and Design 1974-1979. Major illustrator for Department of Ornithology publications including *A Field Guide to the Birds of Western Australia* and *Handbook of Western Australian Birds*.

Tunney, John Thomas (1871-1929). Collector for the Museum between 1895 and early 1900s.

Whitlock, Frederick Bulstrode Lawson (1860-1953). Collector, mainly for H. L.White, but many of his specimens are in the Western Australian Museum.

Whittell, Hubert Massey (Major) (1883-1954). Ornithologist and collector. Some of his specimens are in the Museum.

Woodward, Bernard Henry. Curator of Western Australian Museum 1889-1916.

4

The Role of the Commonwealth Scientific and Industrial Organization (CSIRO) in Australian Ornithology

Ian Rowley[1]

ABSTRACT.—In the 50 years covered by this review, 29 people employed by CSIRO have published papers on Australian Ornithology, 26 of them from the Division of Wildlife Research, under its various names. From its inception in 1949, the justification for the group was to investigate problems posed by primary industries such as agriculture and fisheries. Most of these problems became much less serious than they had first appeared once the scale of damage was recognized. The solution often rested with a relatively minor change in farming procedure and an understanding of the ecology of the birds involved. These were the first scientific studies of field ornithology in Australia and CSIRO remained pre-eminent in this field until well into the 1970s. In the 1960s, as concern over the conservation of fauna increased, the Division moved to studies of potentially endangered species, assisting in the formulation of realistic management strategies and the legislation necessary for conservation. The most significant feature in ornithological research during this time was the formation of the Australian Bird Banding Scheme by CSIRO, which was instrumental in the discovery of the wader flyway to Siberia and which enabled the study of the complex social systems of many Australian birds. Many of these studies were initially "spare time" projects in addition to the usual work of the scientists concerned. In the last 20 years, ornithology became a less important part of the work by CSIRO in relation to wildlife; work has been directed at the ecology of whole ecosystems and the effects of fragmentation of native vegetation that follows widespread land clearing, with subsequent loss of biodiversity.

The Institute of Science and Industry which had been established by the Australian Federal (Commonwealth) Government in 1920 was reorganised into the Council for Scientific and Industrial Research (CSIR) in 1926. Throughout the 1930s there was increasing pressure from Australian scientists for the Commonwealth to coordinate a Biological Survey that would be unhampered by State boundaries; in 1939, the Australian and New Zealand Association for the Advancement of

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Science (ANZAAS) Biological Survey of Australia Committee recommended that the CSIR should undertake the coordination of a nationwide survey. At first the Commonwealth Government was unwilling to support the idea for fear that the States might neglect their responsibilities for pest control and the protection of fauna and flora. Any action by CSIR was shelved with the advent of the 1939-1945 war.

In 1946, Francis Ratcliffe, who had spent two periods of field research in Australia for CSIR in the 1930s (Ratcliffe 1938) and during the war had worked as an economic entomologist on malaria control in New Guinea, put forward the suggestion that CSIR should form a Bureau of Biological Survey. The idea did not receive immediate support and Ratcliffe spent most of 1948 overseas, much of it at Oxford with Charles Elton's Bureau of Animal Population. In 1949, after CSIR became the Commonwealth Scientific and Industrial Research Organisation (CSIRO), the new chairman, Ian Clunies Ross, supported Ratcliffe in the formation of the Wildlife Survey Section to undertake a comprehensive biological investigation of the rabbit and its control and also "any other problems relating to native or introduced mammals or birds that might merit study because of economic or national importance" (Anon. 1949).

The first 30 years of the Wildlife Survey Section, later becoming the Division of Wildlife Research, spanned a period of rapid development for ecology and the scientific study of animal behaviour (Lorenz 1950, Tinbergen 1951). Because the initial mandate of the Section was the control of pests, the main focus was on the regulation of animal populations, a field in which a heated debate was developing as to whether the processes were density-dependent or density-independent. Because birds are largely diurnal, they are generally easier to observe than mammals, many of which are nocturnal, and therefore ornithology provided much of the data to fuel this international discussion. For example, Lack (1954) investigated the role of reproduction and mortality in population regulation, finding food shortage the most limiting factor, but that different species varied widely in their responses, depending on the environment in which they lived. The role of social organisation as a factor in population dynamics was also recognised (Wynne-Edwards 1962). Most of this work was carried out in the Northern Hemisphere and it became evident that the ecology of Australian species was very different and in need of study.

CSIRO consisted of a number of Divisions, each covering different fields of research, funded by the federal government to undertake research for the benefit of the nation. Each Division was headed by a Chief who was ultimately answerable to the Executive Council of CSIRO and its Chairman. The Chief was responsible for the establishment and funding of the various research projects which usually involved a "research officer" and one or more technical assistants. Large Divisions (such as Wildlife Research became) established regional laboratories each with an "Officer-in-Charge" responsible for the day-to-day administration of several teams investigating different official projects. The role of CSIRO in Australian Ornithology is largely confined to work done by the Wildlife Survey Section and its successors, and is best viewed in three eras corresponding to the head of the Section or Division at that time: Francis N. Ratcliffe (1949-61), Harry J. Frith (1961-81), and Brian H. Walker (1985-2001). Each change-over between eras was preceded by a review of the group by the CSIRO Executive and a major change in the emphasis of research. In addition there were individuals in other divisions who contributed to Australian ornithology.

The first involvement of CSIR with ornithology was in 1947 when the Fauna Board of Tasmania sought assistance to evaluate the sustainability of annually harvesting young Short-tailed Shearwaters (*Puffinus tenuirostris*), also known as the mutton-bird, an endemic burrow-nesting procellariform breeding in the Furneaux Islands of Bass Strait. Each year, shortly before they emerged to go to sea, the fat nestlings were pulled from their burrows by itinerant birders, killed, plucked and smoked, providing a delicacy for eating, down for pillows and quilts, and valuable oil. Dom L. Serventy, a lifelong dedicated ornithologist, had joined CSIR Fisheries Division in 1937. He spent long sea voyages in fisheries research vessels and became very familiar with seabirds around Australia; he was the obvious choice to investigate this mutton-bird industry and this became CSIRO's first ornithological project (Serventy1957a).

F. N. Ratcliffe (1949-1961)[italicized dates following names indicate CSIRO tenure].—In 1949, Francis Ratcliffe was appointed Officer-in-Charge of the newly formed Wildlife Survey Section, based in Canberra (Figure 1). In the early years the Section was swamped by the surprise outbreak of myxomatosis and the need to find its vectors and to

Figure 1. F. N. (Francis) Ratcliffe, founder of Wildlife Survey Section.

monitor its spread. The success of this event meant that this new group was viewed kindly by CSIRO Council and this led to increases in funding and staffing. In particular, Dom Serventy transferred from the CSIRO Fisheries Division to establish a wildlife group in Western Australia (WA) and Harry Frith transferred from Irrigation Research at Griffith. In addition, an experienced research ornithologist, Robert Carrick, was recruited from Scotland to boost the Section's scientific profile. Carrick was also familiar with the organisation and requirements necessary to establish a bird-banding scheme, which was the first focus of his attention. The Australian Bird Banding Scheme was started in 1953 and throughout the next 30 years (1953-1984) CSIRO provided the administrative personnel to keep the scheme functioning as the overall authority to band birds, subject to approval by the various state authorities. At first Noel Turnbull, the Section's librarian, managed the Scheme, but it came to require more than part-time attention and a full-time Secretary was appointed in 1957. In this role Warren Hitchcock (1957-1966) and David Purchase (1966-1984) administered the Scheme

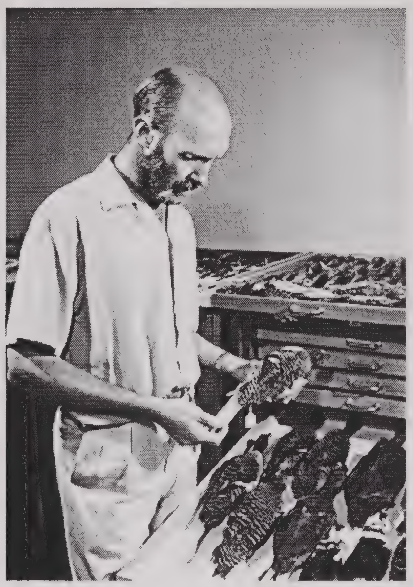

Figure 2. W. (Warren) Hitchcock formed the Divisional collection and maintained it.

that provided CSIRO projects with an invaluable tool; they also initiated many amateurs into the ways of accumulating scientifically acceptable data from their individual studies, a job requiring patience and diplomacy (Figures 2, 3). On 1 July 1984, the scheme was officially handed over to the Australian National Parks and Wildlife Service.

Official projects were usually initiated at the request of one or more State government departments and were supported by the Chief of the Section/Division for approval by the Executive of CSIRO. In the 1950s, little was known about the life histories of most Australian birds, which meant that requests for either pest control or conservation required intensive long-term studies before sensible management options could be formulated. Simplistically it was recognized that at that time only CSIRO had the capacity to embark on such research and it was generally understood that it was their role to do these long-term studies and to present the relevant responsible State authorities with sound advice for them to act on. In the 1950s, the charter of the Section was orientated towards species of economic importance, frequently

Figure 3. David Purchase was responsible for administration of the Australian Bird Banding Scheme from 1967 until mid-1984, when it passed to the Australian Government Department of Environment.

pests of agriculture, but with an increasing interest in conservation. Nevertheless Ratcliffe and CSIRO Chairman Ian Clunies Ross were well aware of the need to stimulate the natural curiosity of their young zoologists rather than straight-jacket them into bread-and-butter economic research. To this end it became an unwritten law that four of the five weekdays were to be spent on “official projects” and the fifth on what became known as CDK (Chief Didn’t Know, a continuing misnomer!), projects chosen by the scientists.

In 1956, the first issue of the house journal *CSIRO Wildlife Research* was published for “publication of the research of its [CSIRO’s] Wildlife Survey Section, mainly on mammal and bird ecology, control, and conservation.” The series ran through 14 volumes until Frith established it as *Australian Wildlife Research* in 1976, with contributions from outside the Division. Subsequently, in 1991, it became one of a series of Australian Journals of Scientific Research with an international focus and shortened title *Wildlife Research*.

H. J. Frith (1961-1981).—In 1960, Ratcliffe indicated that with the prospect of the Section's expansion he wanted to give up being in charge. The CSIRO executive reviewed the work of the Section and advertised for a new Officer-in-Charge and from a number of applicants, H. J. Frith was chosen and took up his new role in 1961. The Section became a full Division (Wildlife Research) of CSIRO on 2 July 1962 and expanded rapidly in the fields of marsupial research, conservation, and ornithology. This was a period in which the fields of Island Biogeography (MacArthur and Wilson 1967) and Sociobiology (Wilson 1975) developed and influenced research. It was also the time when the different States embarked on their own research projects on birds, as did the universities. Although still mainly focussed on pest species, the Division carried out extensive surveys in the relatively undescribed areas of the north and centre of the continent and in Papua New Guinea, mapping distributions and building up the Australian National Wildlife Collection.

Besides the contributions of the many individuals identified below, a highpoint of this time was the 16th International Ornithological Congress that was held in Canberra in 1974 with Frith as Secretary General. Despite mid-winter strikes involving fuel supplies and air traffic, the meeting was an unqualified success in no small part due to Frith's determination that it would be. In this he was assisted by everyone in the Division, which had its headquarters in Canberra, especially John Calaby who throughout his life had a deep interest in ornithology and whose knowledge of its literature was always available to his colleagues. Frith and Calaby edited the Proceedings of the meeting which were published in 1976 and which contained many papers on Australian Ornithology. Frith retired in 1981 after suffering a severe heart-attack; he died the next year.

B. J. Walker (1985-2001).—In 1982 Frith was succeeded by C. J. Krebs and the executive of CSIRO merged the Division of Wildlife Research with part of the disbanded Division of Land Resources Management to form the Division of Wildlife and Rangelands Research. Unfortunately, Charley Krebs resigned and returned to Canada for family reasons in 1984, before he could see the results of his reorganisation. Brian Walker became Chief in 1985 and after a further review of the Division by the Executive, the name changed yet again to Wildlife and Ecology following transfers of staff from the former

Divisions of Water and Land Research and of Forest Research. The research portfolio was reviewed in the light of a very changed political climate that recognised the importance of environmental issues and adopted conservation policies based on the maintenance of biodiversity. This meant that the academic luxury of single-species studies was no longer tenable and the research outlook changed to the ecology of communities and of whole ecosystems. Field work was severely disadvantaged by legislation that a person working on his own would not be covered by worker's compensation in the event of an accident; in many cases this doubled the cost of field trips rendering them impractical. It was also the time when computers, modelling and the creation of large data sets enabled complex analyses to become commonplace. Teams from different disciplinary bases found it was easier and faster to gather good data on habitat variables and to predict species occurrences from these completed assessments and to identify the resources on which species depended (Margules et al. 1988, Ludwig et al. 1997). This research was especially directed towards fragmented and disturbed ecosystems such as the wheatbelt of Western Australia (Saunders et al. 1993), the forests and woodlands of south-eastern Australia (Braithwaite et al. 1989) and tropical rainforests (Braithwaite 1985, Crome et al. 1994).

Another approach to the realistic management of birds developed from the Division's research in the wheatbelt of WA. This was to identify the various threats to their persistence and to categorise species in terms of their vulnerability to each threat. By selecting the species most sensitive to each threat a group of "focal species" was arrived at which could provide a focus for management attention. This multispecies, focal-species umbrella (Lambeck 1997) should achieve the protection of a wide range of less sensitive species as well as the nominated most vulnerable, focal ones. Theoretically, this approach should provide the capacity to manage for all species without dealing with each individually (Lambeck 2002, Watson et al. 2001). Yet another approach has been the use of metapopulation concepts to predict the likelihood of a species persisting across a fragmented landscape. An example of this approach for Blue-breasted Fairy-wren (*Malurus pulcherrimus*) is given in Brooker and Brooker (2003).

In 2001 Brian Walker retired, and was replaced by Steve Morton. Amalgamation with elements of the Division of Tropical Agriculture saw the Division's name changed yet again to Sustainable Ecosystems.

Over more than 50 years many people within CSIRO have contributed to Australian ornithology. Some visitors to the Division from other organisations have published on work done during their stay. A summary of this work and selected references follows.

D. L. Serventy (1937-1969).—Dom Serventy's study of mutton-birds, started in 1947, had two foci. First, to elucidate the efficiency of the traditional method of harvesting, he banded large numbers of young nestlings which he returned to their burrows unharmed; later he recovered leg bands from the harvested corpses and assessed the percentage of his banded birds that were taken by the birders. From 1947-1960, 21,974 young mutton-birds were banded on commercial islands and returned to their burrows; 12, 020 (54.7%) of these survived the annual harvesting operation. Second, he started a long-term study of mutton-birds on one small island (Fisher Island), where he aimed to band every adult breeding bird and every chick produced. By accumulating data on their reproductive biology and life history, including their long migration, sensible management could be formulated and thus ensure a sustainable industry (Serventy 1957a, 1961). Following his retirement in 1969 the mutton-bird study was continued by others outside CSIRO and continues to this day, making it one of the longest studies of a species anywhere in the world (Serventy and Curry 1984, Bradley et al. 1991) (Figure 4).

In 1951, Serventy transferred to the Wildlife Section from the Fisheries Division and became Officer-in-Charge of the Western Australian Group, continuing his visits to Bass Strait and its mutton-birds twice a year. He maintained an interest in avian speciation and the history of ornithology (Serventy 1951, 1957b, 1960, 1972), early accepting the theory of Continental Drift. He also investigated the breeding of Zebra Finches (*Taeniopygia guttata*) and the aseasonal breeding of species in response to cyclonic rains, in which he cooperated with A. J. Marshall (Serventy and Marshall 1957). He was a long time supporter of the International Ornithological Congresses, attending meetings at Ithaca (1962) and Oxford (1966) where he presented a plenary paper on mutton-birds (Serventy 1967) and was appointed to the Permanent Executive Committee of the IOC. Serventy maintained widespread interest in the distribution and breeding of WA birds (Serventy and Whittell 1948). In 1971, he published *The Handbook of Australian Seabirds* with his brother Vin and John Warham (Serventy et

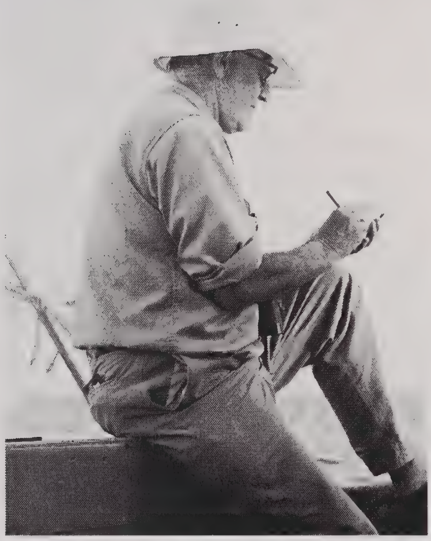

Figure 4. D. L. (Dom) Serventy, the first ornithologist in CSIRO, best known for his initiation of the long-term study of the mutton-birds of Bass Strait.

al. 1971). He died in 1988. In 1991, a medal was struck by the Royal Australasian Ornithological Union in his honour and is presented annually for excellence in ornithological research.

H. J. Frith (1946-1981).—In 1951, Harry Frith was assigned part time to the Wildlife Survey Section from the Irrigation Research Station at Griffith, New South Wales (NSW), to help monitor the spread of myxomatosis. He was formally transferred to the Section in 1952 when the Irrigation Research and Extension Committee requested CSIRO to investigate the bionomics of wild ducks in the irrigation area. He undertook an extensive banding program to elucidate waterfowl movements, as part of an overall study of their ecology (Frith 1957a,b). This was the start of several years investigating the ecology of waterbirds in inland NSW that was only halted temporarily by drought in 1959 (Frith 1959a,b,c,d, 1962b,c, 1965).

After the end of the 1939-1945 war, attempts were made to grow rice in the Northern Territory. The place selected for this, Humpty Doo, was also a breeding ground for Magpie Geese (*Anseranas semipalmata*), and in consequence, considerable crop losses occurred. In 1955, CSIRO was asked to investigate the extent of the problem and Frith carried out an initial survey. He was joined by S. J. J. F. Davies in 1956 and over the next three years, the breeding biology and general ecology of Magpie Geese were studied in detail showing that breeding takes place in the wet season from January to April, in swamps with the right density of spiked-rush *Eleocharis* spp. in the right depth of water to build their nest. The particular requirements for breeding habitat might well have been eliminated, as they had been in most other parts of Australia, if some of the northern floodplain were not reserved from settlement. This study was the first attempt to understand waterfowl ecology in a tropical environment with two seasons—a wet and a dry—rather than the four usual in temperate climates (Frith and Davies 1961a); they also studied the timing of breeding by the avifauna (Frith and Davies 1961b). This brought Frith face-to-face with conservation in the Northern Territory, a field that was to preoccupy him for the rest of his life.

Early in his time at Griffith, Frith had become interested in Malleefowl in response to widespread concern at the decline of the species in New South Wales following the great increase in the clearing of the mallee scrub after the Second World War. He investigated how the nest mound was manipulated to incubate the succession of eggs laid by the female at intervals over three or four months, each taking about 50 days to hatch (Frith 1956a, 1959e) (Figure 5). The heat necessary for incubation came from the fermentation of the incorporated vegetation or the warmth of the sun. Frith placed heating coils in a mound, connected to thermocouples and powered by a generator nearby; he found that the male could detect changes of one degree and manipulate temperature changes by opening or closing the mound (Frith 1957c). This study was an example of early field experimentation in a behaviour study and will remain the classic CDK project (Frith 1962a,d). The merit of the work was realised and appreciated to such an extent that CSIRO's official Christmas Card for 1955 pictured a pair of Malleefowl. Part of the caption read "detailed knowledge of the bird's temperature regulating habits has come from the spare-time studies made over several years as a private hobby by Mr. H. J. Frith of the Organisation's Wildlife Survey

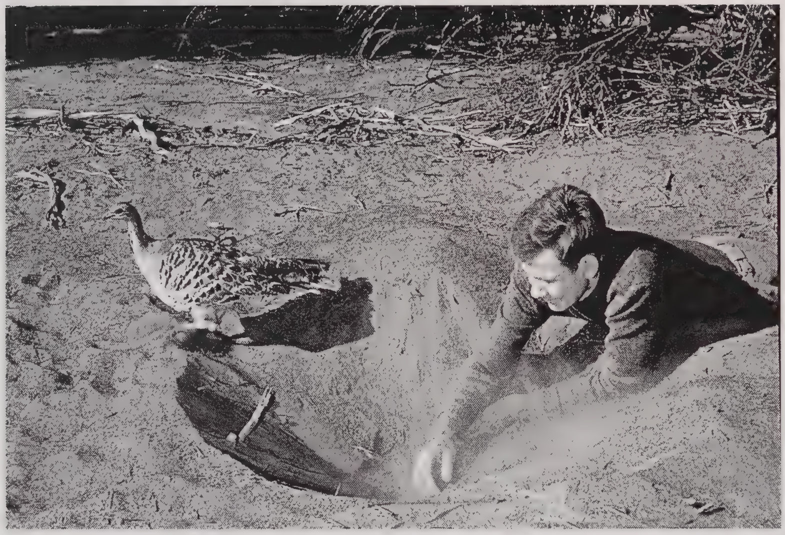

Figure 5. H. J. (Harry) Frith, second chief of CSIRO Division of Wildlife Research, studied Malleefowl, ducks, and pigeons.

Section." Frith spent a large part of 1954 at Oxford University with David Lack at the Edward Grey Institute. He presented a paper on his Malleefowl work at the 11th International Ornithological Congress at Basel, Switzerland (Frith 1955). This was very well received, and R. E. Moreau, then editor of *Ibis*, encouraged Frith to review the breeding habits of the Family Megapodiidae (Frith 1956a). Unfortunately his conclusions about the conservation of Malleefowl were not expressed strongly enough to produce preservation of the really good mallee habitat that supports a large density of Malleefowl to provide a source population to revitalise poorer habitats. That habitat was still being cleared in 1997. Although Frith had grown up amidst pigeons in the rainforest of northern New South Wales, it wasn't until 1962 when he began to do serious fieldwork on them that he realised most of them were canopy species, impossible to watch as they were hidden in foliage. As Chief of the Division, much of his time was spent in Canberra, and so he replaced the north wall of his office with glass, forming a large aviary that was well planted and heated. In this all Australian dove species were kept and most bred. Microphones fed into a tape recorder on his desk, which also carried a permanently focused movie camera. Besides providing much of the material used in his book on *Pigeons and Doves of Australia* (Frith 1982), I am sure the presence of the birds kept him sane while he dealt with our problems. In addition he could draw on the services of many colleagues who collected pigeons from all over Australia, providing him with behavioural, physiological, breeding, and ecological data (Frith and McKean 1975; Frith et al. 1974, 1976a,b). As one envious University department called this, it was "last supper ecology."

At this time, the most recent list of Australian birds was the 1926 RAOU Checklist, which had become out of date. State and Commonwealth authorites had difficulty with the varied nomenclature in use in different parts of the country so the 1962 Conference of Australian Fauna Authorities decided that CSIRO Division of Wildlife Research should compile an index of bird names currently in use. This was prepared by Frith with the help of John Calaby, and incorporated the most recent taxonomic arrangement (CSIRO 1969). Although the index was intended for use by use by fauna authorities, it served as the general checklist until a new RAOU checklist appeared in 1975. Frith also wrote books on waterfowl and conservation (Frith 1967, 1973) and edited *Birds of the Australian High Country* (Frith 1969), which was really the first field guide since *What Bird is That?* (Cayley 1931), and the *Readers Digest Complete Book of Australian Birds* (Frith 1976), in both of which he drew heavily on the work of Divisional staff. Frith and other members of the Division provided help and encouragement to Peter Slater in compiling his *A Field Guide to Australian Birds* (Slater 1970). In conjunction with M. H. Waterman in South Australia, Frith initiated studies of Stubble Quail (*Coturnix pectoralis*), regarded as a game species (Frith and Carpenter 1980). This involved banding 15,177 quail of which 4% were recovered, shot (Frith and Waterman 1977; Frith et al. 1977).

F. N. Robinson (1949-1971).—In 1961 advances in sound recording suggested that studies of animal communication might help explain social behaviour and might even offer a means of controlling pests by broadcasting alarm and other calls. Norman Robinson (Figure 6) established a sound recording laboratory with the latest equipment and with Frith embarked on a study of the Superb Lyrebird (*Menura novaehollandiae*) at Tidbinbilla near Canberra (Robinson and Frith 1981). He maintained a life-long interest in lyrebirds and their mimicry of the calls

Figure 6. F. N. (Norman) Robinson, first Technical Secretary of the Division, who developed expertise in avian sound recording, and began a national collection of wildlife sounds.

of other species (Robinson and Curtis 1996). A start was made in the creation of a Wildlife Sound Library, a catalogue of which was presented at the 16th IOC in Canberra in 1974 (Robinson 1970). In 1965, Robinson transferred to Western Australia and began a study of the Noisy Scrub-bird (*Atrichornis clamosus*) that had only recently been rediscovered and was thought to be critically endangered; in this he was joined by G. T. Smith in 1970 (Smith and Robinson 1976). They developed ways in which the almost invisible, cryptic scrub-bird could be reliably censused by its calling. Robinson also developed a method for scaring Silvereyes (*Zosterops lateralis*) from vineyards (Knight and Robinson 1978) and continued to maintain the collection of recordings of Australian birds. When Robinson retired, P. J. Fullagar undertook the maintenance of the archival collection now housed as the National Wildlife Sounds Collection in Canberra (Fullagar and Robinson 1987).

Figure 7. R. (Robert) Carrick, a Scot who became fascinated by the Antarctic and conducted a long-term study of Australian Magpies.

R. Carrick (1952-1971).—In 1952 Ratcliffe recruited Robert Carrick from Aberdeen University where he had been engaged in a long-term study of the European Starling (*Sturnus vulgaris*), was familiar with quantitative population biology, and had been supervising a number of Ph.D. students. With his experience of bird banding in Scotland, Carrick started the Australian Bird Banding Scheme in 1953 and oversaw its initial development (Figure 7). With many assistants he surveyed the food and breeding requirements of both Straw-necked (*Threskiornis spinicollis*) and White (*T. molucca*) ibis throughout New South Wales and southern Queensland (Carrick 1959, 1962). Both depend on suitable water conditions for breeding, usually following extensive flooding, with vegetation above sufficient water to afford good protection from ground predators. The consensus of opinion was that although ibis did not make significant inroads on swarming locusts, their breeding areas should be protected and the Macquarie Marshes in NSW were proclaimed as a reserve.

Carrick's main study was that of the Australian Magpie (*Gymnorhina tibicen*) a large (c. 350 g) indigenous passerine insectivore that forages at ground level over open pastures and nests and roosts in nearby trees throughout Australia. When Carrick had settled in Canberra, he realised that there was a large easily visible population of magpies around Gungahlin, the Section's headquarters, and appreciated that magpies would provide an excellent example of the value of studying individually colour-banded birds. It would also enable him to investigate the importance of territory in the limitation of population numbers, a theme that was at the heart of the developing field of avian ecology (Carrick 1963, 1972). The magpie story served to illustrate the importance of understanding the social organization within such long-lived species to appreciate the dynamics of their populations.

Besides the Australian Magpie study, Carrick initiated a widespread banding program of the Silver Gull (*Larus novaehollandiae*) with an old friend, M. D. Murray, a veterinary pathologist in CSIRO Division of Animal Health (Carrick et al. 1957, Carrick and Murray 1964, Murray and Carrick 1964). Durno Murray went on to carry out research on albatrosses after he left CSIRO. Carrick was fundamental in establishing Antarctic Research protocol (Carrick 1960) and supervised many Antarctic ornithological studies particularly those on the Royal Penguin (*Eudyptes chrysolophus schlegeli*) and Wandering Albatross (*Diomedea exulans*) on the Australian territory, Macquarie Island (Carrick 1972, Carrick and Ingham 1970). Carrick was disappointed not to have been appointed Chief of the (then) Division when Francis Ratcliffe retired and he found it difficult to work with the new Chief, Harry Frith. After moving to Adelaide where he had been assigned part time to the Mawson Institute, Carrick initiated a further intensive study of the Silver Gull (Carrick 1972), but his chief interests were Antarctic seabirds (Carrick and Ingham 1967, 1970). None of Carrick's work received the write-up that such long projects deserved, mostly being published in relatively inaccessible publications (Carrick 1963, 1972, Carrick and Ingham 1967, 1970). He retired in 1971 and in 1988 died in Scotland.

I. C. R. Rowley (1952-1991).—From 1955-1960 Ian Rowley caught and colour-banded the Superb Fairy-wrens (*Malurus cyaneus*) around the Section's headquarters at Gungahlin, while assisting Carrick with the start of the magpie study (Rowley 1957, 1962) and working on

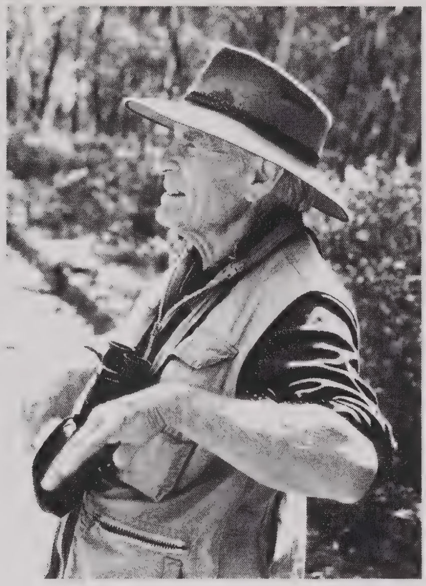

Figure 8. I. C. R. (Ian) Rowley was interested in individual behaviours and social organisation of animals, particularly birds: fairy-wrens, ravens, and cockatoos. Photograph courtesy of N. Emlen.

rabbits. The CDK nature of this project belied this categorization since Ratcliffe gave Rowley (Figure 8) constant encouragement, finding the wren story a pleasant change from his usual Chief's diet of rabbit biology. When finally published (Rowley 1965a), this work was the first study of a colour-banded cooperatively-breeding species and drew attention overseas (Lack 1968). It was also the start of his continuous thread of interest in the social organisation of birds, particularly cooperative breeding, that continues to this day (Rowley 1976, 1983, Rowley and Russell 1991). In 1961, after the CDK wren study was completed, Frith released Rowley from the rabbit work, which had been his main field since 1952, and suggested he study the problem of crows and ravens interacting with lambing flocks of sheep. Initially, this required the different species of uniformly black birds to be clearly recognized after years of confusion (Figure 9). "Black-eyed crows and

Figure 9. L. A. (Les) Moore (Left), I. C. R. (Ian) Rowley (centre), G. S. (Graeme) Chapman (right), collecting ravens in the course of a study of raven taxonomy in Australia.

white-eyed ravens" had been a crude rule of thumb, whereas in reality all species had brown-eyed young and white-eyed adults. Ultimately five species were recognized and their comparative ecology and social organisation described (Rowley 1970a,b, 1971, 1973a,b,c,d, Rowley and Vestjens 1973, Rowley et al. 1973). All Australian crow species are opportunistic scavengers, rarely primary predators. From 1961-1968 Rowley caught and individually colour-banded 346 White-winged Choughs (*Corcorax melanorhamphos*), 136 as known-age nestlings from which it was possible to trace the changes in eye colour over the first four years of life (Rowley 1965b, 1975, 1978). This endemic mud-nest builder was a sociable group-living communal breeder and, as with the wren study, it was featured by Lack (1968) in a widely read book and further fueled the international interest in cooperative breeding (Rowley 1976, 1983). This CDK study was possible because the choughs were sympatric with the colour-banded Australian Raven (*Corvus coronoides*) population that Rowley was studying around his home at Geary's Gap, near Canberra.

In 1969, Frith told Rowley that if he wanted to continue studying birds he would have to move to Western Australia and work on the "last available pest species"—the Galah (*Cacatua roseicapilla*) which he did from 1969-1977 (Rowley 1980, 1990). In 1975, he wrote a book *Bird Life*, reviewing species studies that had been done in Australia to date. From 1978-1983 he studied Major Mitchell's Cockatoo (*Cacatua leadbeateri*) a species that appeared to be endangered and contracting its range; in this he depended largely on his long-time friend and technical officer, Graeme Chapman (Rowley and Chapman 1986, 1991). In 1982 with the arrival of Charley Krebs as Chief, Rowley received official blessing to expand his current CDK study of the Splendid Fairy-wren (*Malurus splendens*) (Rowley 1981) into an official project investigating cooperative breeding in birds with the assistance of Michael Brooker (Brooker and Rowley 1991, 1995, Rowley and Brooker 1987, Russell and Rowley 1993, Rowley et al. 1991) and to accept World Wildlife Fund (WWF) money to study with his wife, Eleanor Russell, the near-threatened Purple-crowned Fairy-wren (*M. coronatus*), another cooperative breeding species, in the tropics (Rowley 1993, Rowley and Russell 1993). They also studied other cooperative breeding malurids: the White-winged Fairy-wren (*M. leucopterus*) (Rowley and Russell 1995), the Red-winged Fairy-wren (*M. elegans*) (Rowley et al. 1988, Russell and Rowley 2000) and in their retirement the Blue-breasted Fairy-wren (Rowley and Russell 2002). They wrote a monograph on the Maluridae (Rowley and Russell 1997) and Rowley edited *Emu*, the journal of the RAOU from 1990-2000.

W. J. M. Vestjens (1956-1980).—Wim Vestjens started with Carrick where he was primarily responsible for the analysis of stomach contents to determine diet, an expertise he continued for the corvids (Rowley and Vestjens 1973). He worked with van Tets on airfield problems (van Tets et al. 1969) and on waterfowl on Lake Cowal, NSW, (Vestjens 1975a,b, 1977).

S. J. J. F. Davies (1957-1983).—After serving his apprenticeship with Frith on the Magpie Geese, Stephen Davies developed his interests in animal behaviour and spent some time studying the behaviour of captive young geese, including the development of nest-building (Davies 1962a,b, 1963) (Figure 10). In 1959, he moved to Western Australia and started a study of the Emu (*Dromaius novaehollandiae*); in 1961 he

Figure 10. S. J. J. F. (Stephen) Davies served his apprenticeship on Magpie Geese under Harry Frith in Darwin. He moved to Western Australia to study black-cockatoos and Emus. Later he became the first Director of the RAOU. Seen here with his wife Wendy, he continued to study Magpie Geese in captivity at home on the outskirts of Perth, Western Australia.

returned to Cambridge where he received his Ph.D. in 1964, before returning to Western Australia and resuming the Emu work (Davies 1976, 1978, 1984, 2002) and starting a study of White-tailed Black-Cockatoos (*Calyptorhynchus baudinii*) (Davies 1966) in which he was joined by Denis Saunders in 1968. In 1971, he became Officer-in-Charge of the WA group on the retirement of Serventy; the group concentrated on the behavioural ecology of cockatoos (Saunders 1982, Rowley 1990, Smith 1991b). Davies completed aviary studies of the behaviour of several species of exotic doves (Davies 1970, 1974a,b) and the ecology of birds in the arid zone (Davies 1972, 1977, 1984). He was also very active (CDK) in developing *The Atlas of Australian Birds*, a major undertaking which was published in 1984 (Blakers et al. 1984). In 1984, he left CSIRO to become the first Director of the RAOU.

M. G. Ridpath (1959-1985).—Michael Ridpath had been recruited by Ratcliffe in 1959 and posted to Tasmania to investigate the endemic flightless rail, the Tasmanian Native-hen (*Tribonyx mortierii*), regarded as a serious pest by farmers (Ridpath and Meldrum 1968a,b). Ridpath studied a population of native-hens in an isolated Tasmanian valley, where he trapped and colour-banded the entire population (N=300). Over three years he spent 1930 hrs. watching these birds and developed the first complete ethogram of an Australian bird recognising at least 14 different calls of which he made spectrograms. Native-hens lived in groups of two or three adults with their offspring of up to one year old —usually six or seven birds to a group with a preponderance of males (111:74). Each group defended a territory that usually included some

Figure 11. M. G. (Michael) Ridpath carried out detailed studies of the Tasmanian Native-hen and Wedge-tailed Eagle.

open grass, some close cover, and some marsh or creek. Territorial behaviour limited the population density in the study area and with adult mortality low, surplus year-old birds were forced to disperse and were subjected to much higher mortality before they found somewhere to settle (Ridpath 1972a,b,c). With Reg Moreau, who was visiting the Division, Ridpath considered the evolution and high degree of endemism in Tasmanian birds (Ridpath and Moreau 1966); later with Maynard-Smith the mating system of native-hens was discussed further (Maynard-Smith and Ridpath 1972). In 1967, Ridpath moved to Western Australia to start a study on Wedge-tailed Eagles (*Aquila audax*) (Ridpath and Brooker 1986a,b, 1987). In 1971, he moved to Darwin as Officer-in-Charge to start a Divisional Laboratory there. After a rather traumatic start when Cyclone Tracy obliterated most of

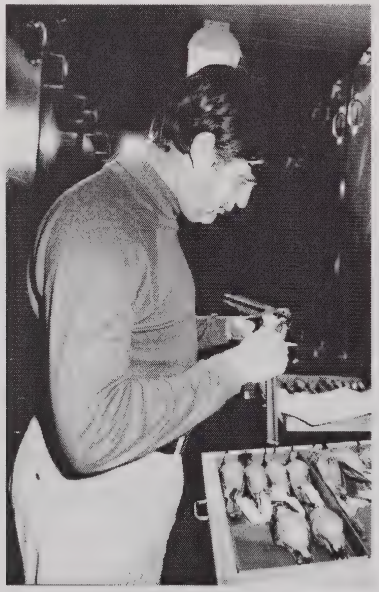

Figure 12. R. (Richard) Schodde transferred to Wildlife after work in New Guinea with the Division of Land Research; studied avian evolution and taxonomy in Australia, and was Curator of the Australian National Wildlife Collection.

the city, this group grew rapidly, centred around the development of an understanding of tropical ecosystems based on a major faunal study of the Kakadu National Park (Ridpath 1985, Braithwaite1985) (Figure 11).

R. Schodde (1960-2000).—In 1970, Richard Schodde (Figure 12) transferred from the CSIRO Division of Land Research where he had worked as a botanist in New Guinea, but had also carried out surveys of the avifauna (?CDK), sometimes in conjunction with Warren Hitchcock (Schodde and Hitchcock 1968, Schodde and Weatherley 1983, Schodde and Mathews 1977). Schodde has published more than 100 papers largely on ornithological taxonomy (Schodde and Mason 1975, Schodde and McKean 1972, 1973, 1977, Schodde et al. 1979, 1980). With Les Christidis he introduced the developing field of molecular taxonomy to Australian ornithology (Schodde and Christidis 1987, Christidis and Schodde 1991, 1997, Baverstock et al. 1992, Schodde 2002). He was instrumental in establishing a standard nomenclature (Schodde 1975) and a wider understanding of avian evolution in Australia (Schodde 1982a). In his role as curator of the Australian National Collection he and his assistants carried out numerous biological surveys, most of which will be covered in Chapter 6 of this book, dealing with that Collection. He has also published four books, three of them co-authored with Ian Mason (Schodde 1982b, Schodde and Mason 1980, 1997, 1999).

G. W. Arnold (1960-1994).—After working for most of his career with the Division of Plant Industry, Graham Arnold transferred to Wildlife and Ecology in 1981, where he completed writing up earlier ornithological studies (Arnold et al. 1987, Arnold 1988, 1989a,b, 2003) and participated in the WA Group's wheatbelt studies (Arnold and Weeldenburg 1990, 1998).

M. G. Brooker (1961-2002).—As in other parts of the world where large raptors have been regarded as vermin by pastoralists or game managers, bounties were paid on Wedge-tailed Eagles in Western Australia until 1968. Ridpath was joined by Michael Brooker (Figure 13) who had transferred from CSIRO Division of Animal Genetics and from 1967-1976 they studied populations of eagles in the arid zone of Western Australia, where they found that breeding was dependent on and geared to the occurrence of a minimum level of available prey. In

Figure 13. M. G. (Michael) Brooker transferred to Wildlife from Animal Genetics and worked with Ridpath on Wedge-tailed Eagles, and subsequently on many other species in the wheatbelt of Western Australia, including fairy-wrens. Photograph courtesy of Lesley Brooker.

the south-west Mediterranean region, breeding success was higher than in the Arid Zone. The eagle's conservative breeding strategy showed that it was ecologically successful in both zones, but least so where the climate was extremely erratic. (Brooker 1974, Ridpath and Brooker 1986a,b, Brooker and Ridpath 1980). The team also contributed a thorough survey of the avifauna of the Carnarvon region and the Nullarbor plain (Brooker and Estbergs 1976, Brooker et al. 1979). In the mid-1970s, Brooker was relocated to Canberra and took part in surveys of the south coast of NSW (Nix et al. 1978), Kakadu National Park (Brooker and Braithwaite 1988, Brooker et al. 1990) Narran Lake and Macquarie Marshes NSW (Brooker 1992, 1993) before returning to Western Australia where he joined Rowley on the *Malurus splendens* study (Brooker et al. 1990, Rowley et al. 1991, Brooker and Rowley 1991, 1995) and continues to monitor this project to this day (Brooker 1998, 2001, Brooker and Brooker 1995). He also studied the endangered Thick-billed Grasswren (*Amytornis textilis*) on Peron Peninsula, WA (Brooker 1988, 1989) and surveyed the bird fauna of Garden Island, WA (Brooker et al. 1995). Michael and his wife Lesley are particularly interested in cuckoos (L. Brooker et al. 1990, L. Brooker and M.

Brooker 1990, 1998, M. Brooker and L. Brooker 1986, 1987, 1989a, 1992, 1996, M. Brooker et al. 1988) and published a comprehensive review of nest parasitism by Australian cuckoos (M. Brooker and L. Brooker 1989b). They completed a unique study of dispersal in *M. pulcherrimus* between remnants in the Western Australian wheatbelt (M. Brooker and L. Brooker 1997, 2001, L. Brooker and M. Brooker 2002) leading to a regional study of the distribution of the species, its metapopulations, and its prospects for survival (L. Brooker 2002, L. Brooker and M. Brooker 2003). Lesley also worked for CSIRO Sustainable Ecosystems, developing ways of re-designing and restoring agricultural lands for the conservation of declining avian species (L. Brooker et al. 1999, Freudenberger and Brooker 2003).

L. W. Braithwaite (1962-1998).—One of Frith's first objectives as Chief was to re-establish the waterfowl investigations in inland New South Wales that had temporarily ceased in the 1959 drought year. In this he was joined by Wayne Braithwaite (Figure 14) who had worked

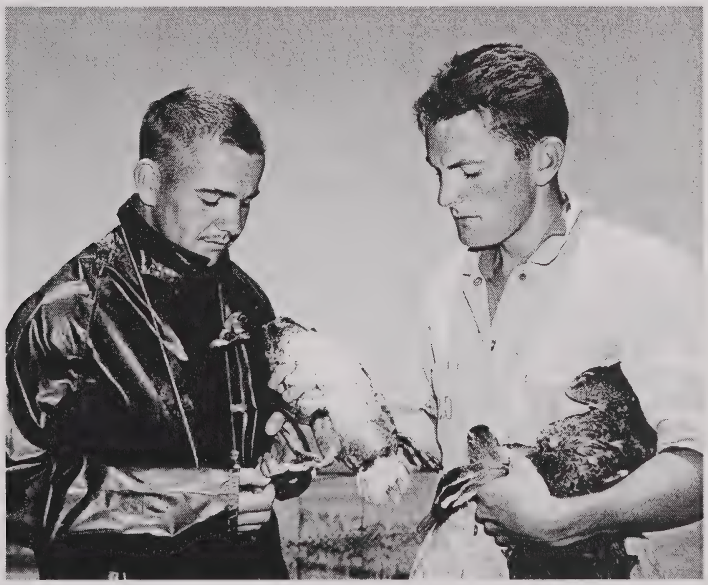

Figure 14. L. W. (Wayne) Braithwaite (right) took over the inland waterbird investigations when Frith became Chief of the Division of Wildlife Research. On left is John McKean.

with him as a schoolboy on the Malleefowl and on ducks during vacations; from 1962 to 1967 they studied nine species of duck on Barrenbox Swamp 19 km west of Griffith (Braithwaite and Frith 1969a,b, Frith et al. 1969). Braithwaite studied the life history and ecology of the Black Swan (*Cygnus atratus*) (Braithwaite 1977, 1981a,b, 1982) and the Mountain Duck (*Tadorna tadornoides*) (Braithwaite 1976, McKean and Braithwaite 1976), waterbirds around Alice Springs (Braithwaite and Stewart 1975) and on the Paroo (Maher and Braithwaite 1992). He also carried out aerial surveys of waterfowl in NSW between 1983-1999 (Braithwaite et al. 1985, 1986, Kingsford et al. 1999). Braithwaite also investigated the sexual cycles of ducks (Braithwaite and Frith 1969a,b), corvids (Rowley et al. 1973) and pigeons (Frith et al. 1974, 1976a). In the 1980s he surveyed the vertebrate forest fauna of eastern New South Wales with Mark Clayton (Braithwaite et al. 1989).

G. S. Chapman (1962-1993).—Chiefly renowned for his skill and perseverance as a bird photographer, Graeme wrote and illustrated a book on common city birds (Chapman 1969), a paper on Apostlebirds (*Struthidea cinerea*) (Chapman 1998) and contributed several illustrated articles for the popular journal *Wingspan*. He co-authored two papers on Major Mitchell's Cockatoos (Rowley and Chapman 1986, 1991) and provided photographs for many books and papers produced by his colleagues in the Division of Wildlife Research.

J. L. McKean (1962-1981).—John McKean started with the Division in Canberra where he worked on waterfowl (McKean and Braithwaite 1976), doves (Frith and McKean 1975, Frith et al. 1976b) and seabirds (McKean and Vernon 1971, McKean and Fullagar 1976); he drew attention to the brush tongues of woodswallows (McKean 1969). Transferred to Darwin, he produced papers on new records for the Northern Territory and for Timor (McKean et al. 1975a,b), monitored Magpie Geese (*Anseranas semipalmata*) (Tulloch and McKean 1983) and with Dick Schodde investigated New Guinea Birds of Paradise (Schodde and McKean 1972, 1973, 1977).

G. F. van Tets (1963-1994).—In 1963, Gerry van Tets began a study of the incidence of bird-aircraft collisions on airports, particularly on Sydney's Kingsford-Smith airport where the main problem

Figure 15. G. F. (Gerry) van Tets first employed to investigate air strikes of birds. The osteological collection he developed for the air-strike studies led to an interest in fossil birds. He maintained a long-term interest in cormorants. Here with W. J. M. (Wim) Vestjens (right) sorting material collected for food studies.

appeared to be Silver Gulls. He located a threefold problem: the gulls were foraging on a nearby open rubbish tip, they liked to roost in "safety" on shallow flooded areas of the airfield, and other insectivorous birds foraged extensively over the grassland. By closing the tip, improving airfield drainage, increasing the mowing of the grass, and treating it with insecticide, the reports of bird strikes and damage to aircraft were reduced (van Tets 1969a,b). He also surveyed bird-aircraft problems on airfields throughout Australia (van Tets et al. 1969). In the course of this work, van Tets built up an extensive collection of avian skeletal material to enable identification of air-strike victims; this developed into part of the National Osteological Collection now numbering more than 2000 specimens. He also worked on fossil birds (Van Tets et al. 1988, Van Tets and Rich 1990). In the 1970s, van Tets studied cormorants and related birds on various islands and Lake Cowal, NSW. Much of the latter field work was done by Wim Vestjens (Vestjens 1975a,b, 1977) (Figure 15).

Figure 16. P. J. (Peter) Fullagar worked on the program that saved the Lord Howe Island Woodhen from extinction; latterly he has been mainly involved in waterfowl research.

P. J. Fullagar (1963-1991).—While employed in CSIRO as a rabbit ecologist, Peter Fullagar (Figure 16), with John Disney, was largely responsible for saving the Lord Howe Island Woodhen (*Gallirallus sylvestris*), a flightless rail whose population appeared to be only 20-25 in 1975 (Fullagar and Disney1975, 1981). Three pairs of hens were established in captivity; they bred prodigiously and their progeny were released so that by 1983 the population in the wild had exceeded 200 birds (Fullagar 1985). In 1979, Fullagar transferred to waterfowl research and worked at Booligal with Briggs and Marr from NSW National Parks and Wildlife Service until the dry years 1981-1982 caused the swamp to dry up and studies concentrated on behaviour of captive birds in Canberra and elsewhere (Fullagar and Carbonell 1986) and extensive fieldwork on Freckled Duck (*Stictonetta naevosa*) (Fullagar et al. 1990). On the retirement of Norman Robinson, Fullagar

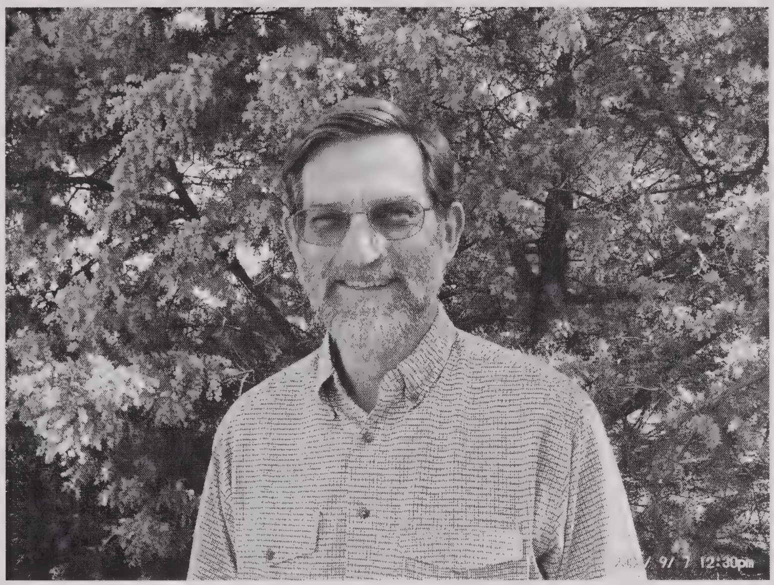

Figure 17. D. A. (Denis) Saunders joined Stephen Davies to work on black-cockatoos, and later developed studies of landscape ecology, especially fragmentation issues and wildlife corridors. Photograph courtesy of V. Saunders.

undertook the management of the National Wildlife Sounds Collection, producing many of the sonagraphs printed in the volumes of the *Handbook of Australian, New Zealand, and Antarctic Birds* (1990-2006, Oxford University Press, Melbourne).

D. A. Saunders (1968-2002).—In 1968, Denis Saunders (Figure 17) joined Davies in Western Australia to investigate the problem caused by White-tailed Black-Cockatoos eating *Pinus* cones that the foresters needed for the collection of seed, and feeding on seeds of apples and pears in the south-west of WA (Saunders 1974a). Unravelling the biology of the species Saunders discovered that there were two different species—a short-billed one in the drier area of the south-west, Carnaby's Cockatoo (*Calyptorhynchus latirostris*), and a long-billed one, Baudin's Cockatoo (*C. baudinii*) in the wetter forested areas of the south-west (Saunders 1974b, 1979, Campbell and Saunders 1976). Saunders found that *C. latirostris* was severely endangered by the continuing clearing of the native vegetation on which the birds depended when raising young (Saunders 1977a, 1980, 1982, 1986, 1990, Saunders and Ingram 1998). He also looked at the vocal repertoire of the species and examined individual vocal recognition (Saunders 1983). This formed the basis of work on individual recognition in other species and the potential to use this as a censusing technique (Wooller et al. 1984, Saunders and Wooller 1988). Saunders also studied the inland form of the Red-tailed Black-Cockatoo (*C. banksii*) (Saunders 1977b), the Long-billed Corella (*Cacatua tenuirostris*) (Saunders 1977c), and with colleagues, cockatoos in general (Saunders and Smith 1981, Saunders et al. 1982, 1984, 1985, Adams et al. 1984).

In 1980, with C. P. S. de Rebeira, Saunders began a CDK project on the avifauna of Rottnest Island, which under Charley Krebs, became a fully supported Divisional project (Saunders and de Rebeira 1985a,b, 1986, Calver et al. 1987). In 1984, as Officer-in-Charge of the WA group, he became interested in the role of remnant vegetation in nature conservation. This led to studies on the conservation of the biota of the extensively cleared wheatbelt (Saunders 1989, 1993, 1996, Saunders and Curry 1990, Lynch and Saunders 1991, Lynch et al. 1995, Saunders and de Rebeira 1991, Saunders et al. 1993). During this period he examined changes since clearing began (Saunders 1989, 1993, Saunders and Ingram 1995). He co-edited a series of books on nature conservation, each gathering contributions from workshops or conferences, many of which are referred to in this chapter. In 1997, he moved to Canberra as Assistant-Chief of the Division and retired in 2002.

G. T. Smith (1970-1993).—Graeme Smith joined CSIRO after two seasons with the Australian National Antarctic Research Expedition on Macquarie Island, studying the Royal Penguin (*Eudyptes chrysolophus*) (Smith 1970, 1974). Smith and Robinson investigated the ecology of the rare and endangered Noisy Scrub-bird (Smith and Robinson 1976, Smith 1985a,b, 1987a, 1996, Smith and Forrester 1981). While completing this study, Smith also studied (CDK) the nearby Western Bristlebird (*Dasyornis longirostris*) and the Western Whipbird (*Psophodes nigrogularis*) (Smith 1987b, 1991a) before turning his attention to cockatoos, particularly the movements and ecology of corellas (Adams et al. 1984, Smith and Saunders 1986, Smith 1991b, Smith and Moore 1991, 1992, Smith and Rowley 1995).

F. H. J. Crome (1970-1995).—Between 1970-1973, Frank Crome was based at Mareeba in North Queensland to investigate pigeons, scrubfowl, and Southern Cassowaries (*Casuarius casuarius*) in the northern rainforest, a little known habitat at that time (Crome 1975a,b,c, 1976, 1978, Crome and Brown 1979). He then worked on waterfowl in inland NSW (Crome 1986), the taxonomy of pigeons (Crome and Johnstone 1979, Crome et al. 1980), the development of plumage in the Plains Wanderer (*Pedionomus torquatus*) hatched in captivity (Crome and Rushton 1975), and the aging of Stubble Quail (*Coturnix pectoralis*) (Crome et al. 1981) before returning to North Queensland, its rainforest and its cassowaries, where he was based in Atherton (Crome 1988, Crome and Moore 1988, 1989, 1990, Crome et al. 1994).

G. N. Harrington (1973-1997).—In 1983, while with the Division of Land Resource Management at Deniliquin NSW, Harrington was involved in a study of the Plains-wanderer (Harrington et al. 1988). After transferring to Wildlife Research and moving to Atherton in North Queensland he became interested in the changes in the avifauna as rainforest gave way to wet sclerophyll forest after frequent burning on the inland margin (Chapman and Harrington 1997).

D. G. Tulloch (1975-1984).—Although primarily working on Water Buffalo (*Bubalus bubalus*) in the Northern Territory, Don also monitored the breeding of Magpie Geese (Tulloch and McKean 1983, Tulloch et al.1988).

P. D. Olsen (1978-1982).—While engaged to work on the Native Water-rat (*Hydromys chrysogaster*), Penny Olsen also worked on the effect of pesticides on waterfowl (Olsen 1984, Olsen et al. 1980) and on eggshell thinning among raptors (Olsen 1982, Olsen and Olsen 1979, 1980, Olsen and Peakall 1983, Olsen et al. 1993) (Figure 18). She left CSIRO to raise her family and to gain her Ph.D. from the Australian National University in 1992, where she remains a Post-doctoral Fellow.

B. F. Green (1978-1998).—As a physiologist, Brian Green studied the energy requirements and osmoregulation of seabirds, particularly some Antarctic breeders (Green et al. 1988, Robertson et al. 1988, Gales and Green 1990, Green and Brothers 1989, Gales et al. 1988, 1993). He also investigated the energy balance of fairy-wrens (Tidemann et al. 1989).

Figure 18. P. D. (Penny) Olsen worked on the effects of pesticides on waterfowl and on eggshell thinning amongst raptors.

P. D. Shaughnessy (1981-present).—Initially with the Institute of Biological Resources CSIRO, Peter Shaughnessy joined Wildlife Research in 1987. Although primarily working on seals he found time to look at birds, particularly in Antarctic waters (Shaughnessy 1990, Shaughnessy and Haberley 1994, Shaughnessy and Shaughnessy 1987, Kato et al. 1996, 2000)

R. J. Lambeck (1990-2000).—Robert Lambeck worked with the wheatbelt group at Kellerberrin and developed the concept of "focal species" to help measure the sustainability of the avifauna in different remnants by concentrating on those species that were regarded as most susceptible to a series of threats (Lambeck 1997, 2002, 2003). This idea has been used elsewhere (Watson et al. 2001).

D. A. Westcott (1999-present).—David Westcott joined the group in Atherton working on Cassowaries (Westcott 1999). He has also shown the value of recording the songs of individual birds to establish geographic variation between different populations of Golden Bowerbirds (*Prionodura newtoniana*); significant differences between populations may have taxonomic value. His work suggests that species concepts may need reviewing to achieve optimum management procedures (Westcott 2002, Westcott and Kroon 2002).

WORK BY MEMBERS OF OTHER DIVISIONS IN CSIRO

R. S. McInnes (1972-1976).—Another cockatoo that caused damage to forestry operations was the Yellow-tailed Black-Cockatoo (*Calyptorhynchus funereus*) in the eastern states that eats woodboring insect larvae such as the Cossid Moth (*Xylentus boisduvali*), which they extract from the trunks of sapling *Eucalyptus grandis* extensively grown in northern NSW as plantations to provide timber for pulpwood. In gouging out the larvae, the birds weaken the trees to such an extent that they may snap in strong winds causing losses of up to 40% in some plantations. Ray McInnes and Phil Carne of the Division of Entomology, CSIRO investigated this problem as it was largely insect oriented. With the assistance of J. E. Courtney, a bird was captured and studied under aviary conditions as it excavated larvae from the 2-m lengths of infested saplings provided. The bird used a unique technique involving creating a “chopping board” to stand on while it extracted the larvae (McInnes and Carne 1978).

J. N. Matthiessen (1973-1975).—In the process of investigating the Potato Moth (*Phthorimaea operculella*) the role of Silvereyes (*Zosterops lateralis*) as potential predators of the moth were studied by John Mattheissen and Brian Springett of the Division of Entomology CSIRO (Mattheissen 1973, Mattheissen and Springett 1973, Springett and Mattheissen 1975).

WORK BY VISITORS TO THE DIVISION

A. S. Leopold (1963-1964).—Starker Leopold spent a sabbatical with the Division and, based in Canberra, he studied the feeding habits of the Wedge-tailed Eagle laying the foundation for the more thorough study of their ecology that followed (Leopold and Wolfe 1970).

S. Briggs (1977-present).—From 1977, Sue Briggs from New South Wales National Parks and Wildlife Service was based at the laboratories of Wildlife Research and its successors in Canberra and has cooperated with members of the Division in waterfowl research (Briggs et al. 1985a,b, Briggs and Holmes 1988, Kingsford et al. 1999) and latterly in landscape ecology (Seddon et al. 2003).

R. B. Payne (1983-1986).—During the breeding seasons of 1983, 1985, and 1986, Bob and Laura Payne from the University of Michigan visited Rowley's Splendid Fairy-wren (*Malurus splendens*) study area to observe the interaction of fairy-wrens with bronze-cuckoos. In 1983, no cuckoos parasitized any wren nest and to investigate the response of group-living birds to the presence of cuckoos a stuffed dummy was placed near an active nest and the response of group members to this invasion was recorded (Payne et al. 1985); these tests were repeated in 1986 (Payne et al. 1988a). The Paynes also investigated individual vocal recognition by testing the response of both Splendid and Red-winged (*M. elegans*) fairy-wrens to recorded calls of conspecifics from within the group, from neighbours, and from previous group members who had dispersed (Payne et al. 1988b, 1991).

J. F. Lynch (1988-1993).—For six months in 1988 and then for three months during the breeding season of 1990, 1991, 1992, and 1993, Jim Lynch of the Smithsonian Institution worked in collaboration with CSIRO in the Kellerberrin study area of the central wheatbelt in joint studies on the movements of birds in a fragmented landscape (Lynch and Saunders 1991). He employed radio telemetry to look at patch-scale movements (Lynch et al. 1995).

CONCLUSIONS

In the 50 years covered by this review, 29 people employed by CSIRO have published papers on Australian Ornithology, 26 of them from the Division of Wildlife Research, under its various names. A selection covering most of the themes covered by these workers is presented in the bibliography. All these authors depended on technical assistance/support for much of their work and while many of these people remain unacknowledged here, their participation must not go unrecognized.

From its inception in 1949, the justification for the group was to investigate problems posed by primary industries, starting with muttonbirds (Serventy), waterfowl (Frith), ibis (Carrick), native-hens (Ridpath), corvids (Rowley), Wedge-tailed Eagles (Ridpath and Brooker), Galah (Rowley), Emu (Davies), and black-cockatoos (Saunders). Most of these problems became much less serious than they had first appeared once the scale of damage was recognized. The solution often rested with a relatively minor change in farming procedure and an understanding of the ecology of the birds involved. These were the first scientific studies of field ornithology and CSIRO remained preeminent in this field until well into the 1970s.

In the 1960s, concern over the conservation of fauna emancipated the Division from a diet of pests, and studies of potentially endangered species were undertaken (lyrebirds, Noisy Scrub-birds, grasswrens, and Major Mitchell's Cockatoo) which enabled the formulation of realistic management strategies. Besides these studies of individual species, widespread surveys enabled a stock-taking of species, their distribution and their taxonomy, enabling legislation necessary for control or preservation to be formulated.

The most significant feature in ornithological research during this time was the formation of the Australian Bird Banding Scheme by CSIRO, which was also available to selected members of the public. This enabled the movements of marked birds to be documented, as shown by Serventy's muttonbirds annually circumnavigating the Pacific Ocean, Australian Grey Teal (*Anas gracilis*) traversing the Australian continent, and the discovery of the wader flyway to Siberia by the Wader Study Group of RAOU. It also enabled individually colour-banded birds to be recognized without recapture, which led to understanding the important role played by social organization and behaviour (Australian Magpies and Tasmanian Native-hens). Banding has also provided information on longevity and survival that has enabled realistic demographic pictures to be drawn.

Besides the "official" projects, the CDK studies provided insights into unusual aspects of ecology; in particular, mating systems other than strict monogamy, which until then, was widely assumed to be nearly universal in birds. Both Magpie Geese and native-hens frequently bred in trios, and Australian Magpies, fairy-wrens, and White-winged Choughs were shown to live and breed in large social groups, usually the result of extended parental care—all very unusual systems compared to those found in the Northern Hemisphere. In particular, the widespread incidence of cooperative breeding (more than a simple pair rearing young) appeared to be unusually common in Australia. Such apparent altruism sparked much academic debate, and suggested multiple causes, including phylogenetic linkages.

In the last 20 years, ornithology became a less important part of the work by CSIRO in relation to wildlife; work has been directed at the ecology of whole ecosystems and the effects of fragmentation of native vegetation that follows widespread land clearing, with subsequent loss of biodiversity.

ACKNOWLEDGMENTS

I thank my colleagues in CSIRO who read and commented on various drafts of this chapter—L. W. Braithwaite, M. G. Brooker, P. J. Fullagar, D. A. Saunders, R. Schodde, and D. A. Spratt; P. J. Fullagar and E. Slater delved in the Division's archives to locate suitable photographs. I am particularly grateful to my wife Eleanor Russell who typed the manuscript and the seemingly endless literature cited with only a few moans. All photographs, unless otherwise indicated, are courtesy of CSIRO.

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5

The Changing Faces of Systematics and Biogeography in Australian Ornithology: A Young Turk's View

Leo Joseph[1]

ABSTRACT.—Australian avian systematics and biogeography acquired a solid foundation in ornithology's checklist era, the heyday of which was in the late 19th and early 20th centuries. Links are explored between the ways in which checklists of Australian birds have evolved and how and why molecular techniques are used to study Australian birds. Also examined is how developments in the theory and practice of systematics and biogeography have been applied in Australian ornithology. Changing views on the origins of Australian birds reflect changing theory and practice in systematics and biogeography generally. The foundation of work by Australia's avian systematists and biogeographers in the mid to late 20th century should continue to provide the basis for an exciting future for students of bird evolution and ecology in Australasia. Similarly, the region's birds should continue to provide a testing ground for the theory and practice of systematics and biogeography and their relevance to avian biology generally.

Robin (2001, 2002) examined the history of the Royal Australasian Ornithologists Union/Birds Australia (RAOU) between 1900 and 2000 and its journal, *The Emu*. Here I complement Robin's work with a review of how the science of Australian avian systematics and biogeography evolved in those 100 years, particularly in the century's latter half. I examine how study of the systematics and biogeography of Australian birds evolved as those fields' philosophical underpinnings changed throughout the century.

Previous reviews of Australian avian systematics and biogeography have covered diverse issues: Australia's avian fossil record (Rich 1976, Rich and Baird 1986), species and subspecies concepts, hybrid zones and minor geographical barriers (Ford 1974a, 1987a,b), cranial

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osteology of non-passerines (Oliver 1945), particular speciation problems (Serventy 1950, 1953, Ford 1974b), Australian biogeography and the practice of systematics generally (Keast 1981a,b, Ingram 1977, Schodde 1989, Serventy 1972a,b). The present review begins with a discussion of the role played by ornithology's 19th century and early to mid-20th century checklist era in giving a foundation to Australian avian systematics and biogeography in the latter part of the 20th century. I then consider the evolution of views on the origins of Australian birds. I then offer a detailed exploration of the foundation beneath the current prevalence of DNA sequence-based methods in Australian avian systematics and biogeography. I examine how that has grown and how it informs Australian avian biology. Dispelling the image of systematics and systematists as dry and crusty (Figure 1) is a further goal!

Figure 1. A popular image of systematists as detached from the study of avian biology persists but will, I hope, be shown by this chapter to be inappropriate. Reproduced with permission from Parkes (1963).

Three caveats are necessary. First, the minimum of theoretical background that I have given will, I hope, enable any reader to follow my discussion. Second, truly exhaustive citation of the literature is impractical if not impossible. The biases of my own interests and experience may mean that I have given what may seem to some undue emphasis, weak or strong, to certain authors and topics. I offer this as an unapologetically personal nuance to the review's writing. No doubt others writing this review would choose different works to cite. The aim I have tried to meet therefore has been to provide a fair and comprehensive, but not exhaustive *entrée* to the literature. More prolific authors posed a special problem. Primarily, I have tried to cite references that show how the diversity of their research contributed to intellectual development of Australian avian systematics and biogeography, while secondarily trying to fairly convey their work's sheer volume. In Australian parlance, I hope everybody got a guernsey who should have one! Third, just as Robin's (2001, 2002) reviews touched on RAOU/Birds Australia's historical involvement with New Zealand and New Guinea, so too this review frequently refers to work on birds of those regions.

Definitions.—Systematics is the study of life's diversity and evolutionary history. It has two components, phylogenetics and taxonomy. Phylogenetics is the means by which the branching pattern of life's evolutionary history, phylogeny, is recovered from sources of data in organisms (e.g., morphology, DNA sequences) and graphically summarized in phylogenetic trees. These trees are diagrams that summarize hypotheses about how the species involved are related to each other and how strong the statistical support in the data is for various groupings of species indicated by the tree's branching pattern (Figure 2). Taxonomy is the application of the rules of biological nomenclature, ideally to summarize phylogenetic hypotheses. Though often used interchangeably, taxonomy is if anything a component of systematics. As is conventional, I refer to questions at the levels of genus, species, or subspecies as ones of "lower" systematics and those at the family and order levels as "higher" systematics.

Historical biogeography is the study of longer-term "evolutionary" processes that have generated the patterns of present-day distributions of organisms. It is often distinguished from ecological biogeography, which focuses more on shorter-term "ecological" processes limiting current distributions (e.g., Brown and Lomolino 1998, Newton 2003). Inevitably, the two overlap and examples from Australian ornithology are analyses of the birds of Cape York Peninsula (Kikkawa 1976). For brevity, "biogeography" will here refer to historical biogeography unless indicated otherwise. If systematics tells us that species A is more

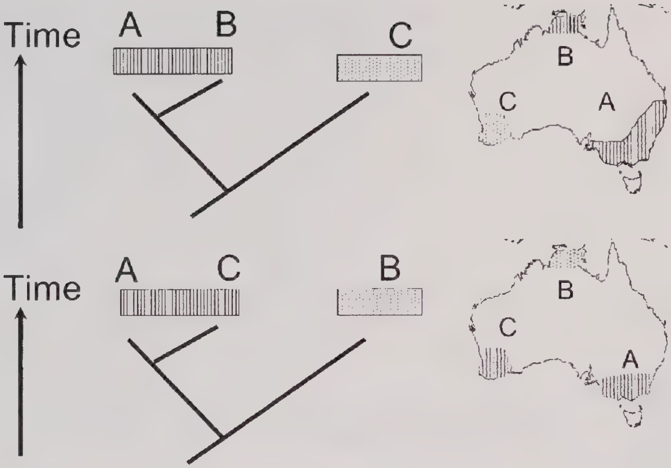


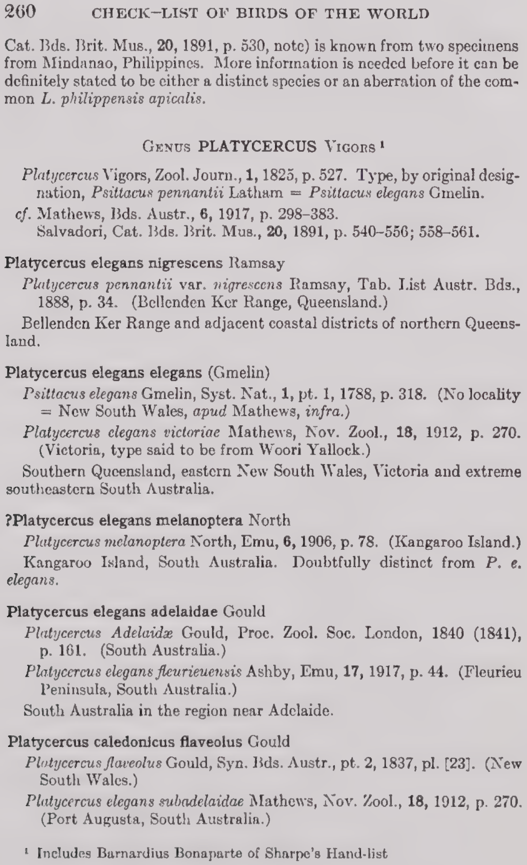
Figure 2. Alternative hypotheses for evolution of taxa A, B and C on the Australian landscape. One might consider the implications of the example when Species A, B and C are the three forms of the Crested Shrike-tit (*Falcunculus frontatus*) or different rosellas *Platycercus* spp.

closely related to species B than either is to species C, then biogeography has to account for that when explaining how all three evolved on the landscape with its own environmental history (Figure 2). In biogeography, the distinction is often made between vicariance, the splitting of the range of an ancestral population into two or more separate distributions usually by climatic or geological events, for example, and dispersal, the establishment of a population in a new area by movement across what is usually a barrier to gene flow (see Brown and Lomolino 1998).

CHECKLISTS AND THE CHECKLIST ERA

Here I examine how the checklist era laid a foundation for and directed much of Australia's 20th century and current avian systematics and biogeography, especially at lower levels.

In Australia as elsewhere, the first half of the 20th century continued the preceding era's work of discovery of birds and museum collection-building (e.g., Mearns and Mearns 1998). Knowledge of bird distribution and museum collections grew at nearly exponential rates (Winker 1996). Just as today's rapidly accumulating DNA sequences are organized in Internet-accessible databases to avoid chaos and ease their retrieval, so too the growing body of data from museum specimens and field discoveries was assimilated into checklists, particularly "annotated checklists" (Figure 3). Annotated checklists are more than just lists of names, however. For most bird species they are summaries of what is often at least a hundred years of study. Closer description of annotated checklists warrants a brief digression.



260 CHECK–LIST OF BIRDS OF THE WORLD

Cat. Bds. Brit. Mus., **20**, 1891, p. 530, note) is known from two specimens from Mindanao, Philippines. More information is needed before it can be definitely stated to be either a distinct species or an aberration of the common *L. philippensis apicalis.*

Genus **PLATYCERCUS** Vigors[1]

Platycercus Vigors, Zool. Journ., **1**, 1825, p. 527. Type, by original designation, *Psittacus pennantii* Latham = *Psittacus elegans* Gmelin.

cf. Mathews, Bds. Austr., **6**, 1917, p. 298–383.
Salvadori, Cat. Bds. Brit. Mus., **20**, 1891, p. 540–556; 558–561.

Platycercus elegans nigrescens Ramsay

Platycercus pennantii var. *nigrescens* Ramsay, Tab. List Austr. Bds., 1888, p. 34. (Bellenden Ker Range, Queensland.)

Bellenden Ker Range and adjacent coastal districts of northern Queensland.

Platycercus elegans elegans (Gmelin)

Psittacus elegans Gmelin, Syst. Nat., **1**, pt. 1, 1788, p. 318. (No locality = New South Wales, *apud* Mathews, *infra.*)

Platycercus elegans victoriae Mathews, Nov. Zool., **18**, 1912, p. 270. (Victoria, type said to be from Woori Yallock.)

Southern Queensland, eastern New South Wales, Victoria and extreme southeastern South Australia.

?Platycercus elegans melanoptera North

Platycercus melanoptera North, Emu, **6**, 1906, p. 78. (Kangaroo Island.)

Kangaroo Island, South Australia. Doubtfully distinct from *P. e. elegans.*

Platycercus elegans adelaidae Gould

Platycercus Adelaidæ Gould, Proc. Zool. Soc. London, 1840 (1841), p. 161. (South Australia.)

Platycercus elegans fleurieuensis Ashby, Emu, **17**, 1917, p. 44. (Fleurieu Peninsula, South Australia.)

South Australia in the region near Adelaide.

Platycercus caledonicus flaveolus Gould

Platycercus flaveolus Gould, Syn. Bds. Austr., pt. 2, 1837, pl. [23]. (New South Wales.)

Platycercus elegans subadelaidae Mathews, Nov. Zool., **18**, 1912, p. 270. (Port Augusta, South Australia.)

[1] Includes Barnardius Bonaparte of Sharpe's Hand-list

Figure 3. Entries from Peters (1942), an annotated checklist typical of avian systematics' checklist era.

Though variable, annotated checklists typically summarize the systematics of the birds of a defined region and their distributions within that region. The sequence in which all taxa such as orders, families, genera, species, and subspecies are listed reflects the author's views about phylogenetic relationships at least to the extent that a two-dimensional list of names can do so. Two species or genera, for example, thought to be closely related, will be listed consecutively. For each accepted scientific name, an annotated checklist gives a synonymy, which lists the different names (synonyms) that have been applied to the taxon in question but which the author judges to be not currently applicable. Literature citations will show where each synonym was published and by whom; for species and subspecies the type-locality of each synonym is also given—the collection locality of the "type" specimen(s) to which the name is anchored. Should later research show a need to re-instate a name listed as a synonym, for example, to split what is currently regarded as one species into two, a name can be reinstated from the available names listed in the synonymy. If no synonym is available, a new name is needed. For that reason alone, it is important to keep track of all available names that have accumulated in a species' taxonomic history and synonymies serve that purpose. Annotated checklists thus bring order to the disparate literature of avian taxonomy and provide a ready indication of whether a new name is needed as taxonomic revisions are done.

That these checklists, which sometimes run to ten or more weighty volumes, were often produced by sole authors working in longhand or on typewriters, makes them all the more remarkable. One still routinely turns to annotated checklists to determine what is meant by an unfamiliar scientific name. Australian examples of how the information in checklists has served field-guide authors as well as ecologists who uncovered the need for taxonomic revisions in their study species is presented below.

North America was the epicentre of checklist production. Checklists were produced there for birds of the world, most certainly including Australia, and the Americas (e.g., Peters 1931-1945, Mayr and Cottrell 1986, Hellmayr 1918-1938). Other important checklists were produced elsewhere such as the multi-authored, multi-volumed *Catalogue of the Birds in the British Museum* (e.g., Sclater 1888, Sharpe 1888, Salvadori 1891) and Pinto's (1937, 1944) lists for Brazil are a South American example.

In Australia, the well-known "1926 *RAOU Check-list*" (hereafter RAOU 1926) exemplified the checklist era. Indeed, RAOU (1926) was the only single checklist for all Australian birds for most of the 20th century. A generation of Australian avian systematists and biogeographers working in and towards the end of the heyday of checklists did much work in its shadow. They produced annotated checklists of the birds of Queensland, New South Wales, Western and South Australia and the Northern Territory, and New Guinea (e.g., Condon 1969, 1975, McAllan and Bruce 1988 (but see Olson 1990), Parker et al. 1979, 1985, Schodde 1977, Schodde and Hitchcock 1968, Storr 1967, 1973, 1980, 1992). Students of Australian avian systematics and biogeography should be familiar with Storr's lists in particular, if only for their scholarly compilation of distributional data. The same generation also produced annotated checklists of specimens collected on expeditions. These often had detailed systematic and biogeographic notes. Fine examples are accounts of the 1960s Harold Hall British Museum Expeditions (Hall 1974), the birds of south-western Queensland (Ford and Parker 1974) and the Great Victoria Desert and southern Western Australia (Ford 1971a,b).

Arguably, regional Australian lists and the national list (RAOU 1926) reflected the checklist branch of twentieth century ornithology generally. As systematics of Australian birds moved ahead with species-by-species reviews (e.g., Boles 1983, Keast 1957, 1958a,b, Parker 1970, Schodde et al. 1980), RAOU (1926) grew increasingly out-of-date. An updated national list was badly needed by the 1960s, if not earlier. Regional annotated checklists, on the other hand, were produced into the 1990s when they seemed to fade away, albeit with a last hurrah of lists from South and Western Australia (Parker et al. 1979, 1985, Storr 1992) and even two lists, one national and one state-based, of all vertebrates (Stanger et al. 1998, Watts 1990). This was not, I suspect, due to checklists being inherently less useful. Instead, national- and regional-level atlas projects and regional (and digital) birdwatching guides simply took over much of their audience (e.g., Barrett et al. 2003, Blakers et al. 1984, Ingram and Raven 1991, Paton et al. 1994, Saunders and Ingram 1995). Also in part, priorities shifted in the museums where they were so often produced, and fewer human and financial resources are now available in museums for their continued updating and production.

Checklists at the national level, however, did continue to appear, but their format evolved radically as new data and hypotheses accumulated on relationships of birds at all taxonomic levels. This evolution is seen in a sequence that begins with Condon's (1975) non-passerine *Check-list*, which followed the conventional format of annotated checklists outlined above. Then Schodde's (1975) *Interim List* of Australian passerines began a welcome trend of including more detailed explanations of the decisions behind the reduction of systematics hypotheses to "bare-bones" linear sequences of names. In Schodde (1975), these hypotheses covered higher- and lower-level questions.

Next was Christidis and Boles's (1994) updated list of all Australian birds, the appearance of which seemed to be accompanied by almost audible sighs of relief among Australian ornithologists. Finally, a single up-to-date list for Australian birds to supersede RAOU (1926) was available. Christidis and Boles (1994) listed genera and species and gave no subspecies or synonymies. Their list was followed by the work's real core: excellent, succinct accounts of reasons for the decisions taken. A new edition will be published soon.

Arguments about Australian avian systematics did not stop, however—no healthy debate would be unhealthy! Those debates and the evolution of national checklists continued with two other major works by Schodde and Mason (1997, 1999). Together with Christidis and Boles (1994), these three publications completed a major transformation of Australia's avian checklists by the close of the century.

Schodde and Mason (1997) gave a zenith of nomenclatural detail in what was essentially a traditional, but most detailed, annotated checklist. New discussion of the decisions behind the systematics was minimal, unfortunately, and certainly left this interested reader hungry for more exhaustive treatments. No new scientific names were introduced. Thorough distribution notes more than sketched the range of each species. Natural history and ecology data similarly sketched in detail the species' biology and relevant literature.

Schodde and Mason's (1999) next, massive work supplied more of that kind of detail. As a monumental and healthily controversial "clearing of the decks" of passerine taxonomy, each of its species-accounts approximates a miniature version of the more traditional single-species taxonomic revisions that have been a hallmark of museum ornithology (e.g., Boles 1983, Ford 1983a, Parker 1970, Schodde and Mason 1976). Each species and subdivision within a species is described and compared (diagnosed) with respect to its close relatives. Many new scientific names were introduced and many old ones reinstated. Distributions were mapped but individual localities were not shown. The "ultrataxon" and "ultrataxa" of Schodde and Mason (1999) will be discussed further below.

The positive response to Schodde and Mason's (1999) *Directory*, in particular from wildlife managers, shows that interest in systematics is alive and growing well beyond systematists themselves. This growth is in part fuelled by ever-increasing numbers of birdwatchers who can turn to the *Directory* for the novelties they seek. More importantly, it shows that the need for systematic research, even at the lower taxonomic levels where Australian birds are even still popularly thought to be well-understood, is evolving and remains as clear as ever. Newer students of systematics should enjoy looking up those old annotated checklists after all!

Checklists, field guides and taxonomic change: Australian examples.—How have seemingly dry annotated checklists informed ecological research on Australian birds and their field identification guides? Examples are below.

Ecological data from ravens (Rowley 1967, 1970) and black-cockatoos (Saunders 1974, 1979) initially made little sense in terms of then prevalent systematics in regional checklists and RAOU (1926) and vice versa. Rowley and Saunders each saw the need to digress into the systematics of their study species. Rowley established that the Australian Raven (*Corvus coronoides*) comprised three species: the Australian Raven (*C. coronoides*), Little Raven (*C. mellori*), and a third species. Checklists showed that a name was available for this third species in synonymies. It is now known as the Forest Raven (*C. tasmanicus*). They also showed, however, that no name was available for the northern New South Wales isolate of the species and so a new name was needed for it. Rowley named it *C. tasmanicus boreus*. Saunders confirmed that white-tailed black-cockatoos of south-western Western Australia comprised two separate forms. Again, checklists showed that no new names were needed, however, and their synonymies revealed which names were available. Thus we have the Long-billed Black-Cockatoo (*Calyptorhynchus baudinii*) and Short-billed Black-Cockatoo (*C. latirostris*). Systematic debate about the relationships of these two black-cockatoos to each other and to other black-cockatoos, and therefore, whether they are treated as species or subspecies, is discussed later in the chapter.

Australian identification guides up to and including Pizzey and Doyle (1980) showed the Grey Fantail (*Rhipidura fuliginosa*) with one illustration. Ford (1981a) reviewed the complex geographical variation and taxonomy of the species and placed the migratory habits of some of its populations in taxonomic context. His work highlighted the distinctiveness of the northern Australian mangrove populations. Checklist synonymies showed that a name was available for them and they are now known as the Mangrove Fantail (*R. phasiana*). Ford also recognized that the population of Queensland's Wet Tropics was diagnostically dark. Checklists showed that no synonyms were available so Ford described them as *R. f. keasti*. Slater et al. (1986) and all later guides illustrate these and other forms of the Grey Fantail complex. All are now keenly sought by birdwatchers. Most importantly, the revisionary work that Rowley, Saunders, and Ford did in these studies set the stage for rigorous phylogenetic study of ravens, black-cockatoos, and the Grey Fantail complex; remarkably, at the time of writing, such work has not appeared. Studies of these birds' biology, in particular migration, will then acquire a robust evolutionary framework that may offer even more insights.

Before leaving the checklist era, a parenthetical note is needed of the biggest Australian checklister of them all—Gregory Mathews—and the chaos he engendered by naming so many subspecies and species of Australian birds on flimsy evidence. D. L. Serventy's presidential address to the RAOU in 1949 (Serventy 1950) is required reading on Mathews. Also, it is still worth quoting a translation of Hellmayr (1914): "It will require the labour of years of conscientious ornithological work to extricate Australian ornithology from the chaos into which Mathews has plunged it." We are still not entirely extricated from that nomenclatural mess.

Checklist Era: Conclusion.—Checklists and the individual papers on which they were based brought to order what was known of geographical variation and species- and subspecies-level taxonomy and distribution. Their authors raised many questions of phylogenetic relationships and historical biogeography, but could only take these questions so far with methodologies available to them. By the 1990s, the endpoint was a wealth of hypotheses, all needing further study, about species limits and relationships among families and orders. Examples abound in Christidis and Boles (1994), Schodde (1975), Schodde and

Mason (1997, 1999) and in individual species-accounts scattered through the many other regional checklists from the mid-20th century. Methodological tools were revitalized in the 1980s onwards with explosive speed by developments in systematics and biogeography on the world stage. The remainder of this review examines how the foundation that checklists lay for revisionary systematic work has been built on in later phylogenetics and historical biogeography. It also examines how systematics and biogeography contribute ever more to Australian avian biology generally. I first examine higher level issues, in particular the origins of Australian birds, and then review lower level systematics and biogeography.

HIGHER SYSTEMATICS AND BIOGEOGRAPHY: ORIGINS OF AUSTRALIAN BIRDS

Higher systematics of Australian birds has been notable for the number of North American workers, some of whom were not ornithologists, who have played key roles in its study. This applies especially to study of the origins of Australian birds. Ironically, Australian ornithologists themselves have only relatively recently taken a more active role. Here I review how and why North Americans played such a major role.

In the middle of the 20th century, Darwin's (1859) theory of evolution by natural selection was re-worked to accommodate advances in genetics, palaeontology, and systematics. The result has long been heralded as The New or Modern Synthesis of Evolution (see Futuyma 1986). Its chief architects, all of whom worked in North America, were Ernst Mayr, George Gaylord Simpson, and G. Ledyard Stebbins. Key ramifications of the New Synthesis for Australian ornithology were profound, but have, surprisingly, rarely been specifically reviewed. First, present-day distributions of organisms were explained by the dominant biogeographical paradigm of dispersal (Darlington 1957). This followed from the then predominant view of static continents and provided the basis for arguing that present-day species evolved their distributions by dispersal of ancestors from one region to another. A second ramification grew from what G. G. Simpson, a mammalian palaeontologist, promoted as the Great American Interchange, an hypothesis arguing North American origins for many South American mammals (the Sherwin-Williams Effect) (Simpson 1980).

The “Sherwin-Williams Effect” describes dispersal-based hypotheses of northern origins for a southern, in this case, Australian avifauna. Sherwin-Williams is a major North American paint company whose slogan is *Cover The World*. Their emblem shows paint falling from north to south over the world. Apparently, this symbol was suggested for Sherwin-Williams by W. D. Mathew (not to be confused with Gregory Mathews) who, long before continental drift was accepted, hypothesized that the mammals of South America had evolved by dispersal of their ancestors from North America into South America (Mathew 1915). B. Patterson (pers. comm.) informs me that Mathew told G. G. Simpson that his concept of “dispersal to southern hemisphere continents from the north” came to him while walking to work one day at the American Museum of Natural History, New York. A third person apparently noted the coincidence that Mathew would have walked each day under a Sherwin-Williams sign! Whatever the veracity or origin of this chain of hearsay, G. G. Simpson later expanded the concept into the theory of the Great American Interchange (Simpson 1980). Given the geological histories of the continents of North and South America and Europe, a North American palaeontologist like Simpson had every reason to use dispersal to explain the histories of fossil mammal faunas. The significance of all this to Australian avian systematics and biogeography brings one of the New Synthesis’s other architects, Ernst Mayr, into this story.

Born in Germany in 1904, Mayr studied in Berlin, and collected birds in New Guinea for Walter Rothschild. In 1931, he moved from Europe to the American Museum of Natural History, New York (AMNH). While based at AMNH, he collected extensively in the southwest Pacific and this work laid the foundation for much of his later work on speciation. He was Professor of Zoology at Harvard University from 1953 to 1975. There he supervised the doctoral work of a leading Australian avian systematist and biogeographer, J. Allan Keast. Mayr single-handedly developed what is still a dominant theory of speciation —allopatric speciation. He died in February 2005 at age 100 and was publishing well into his 90s.

Four years after Simpson’s 1940 paper on the Great American Interchange, Mayr (1944a,b) addressed the role of Timor in the origins of Australian birds. Recalling that Mayr and Simpson were among the chief architects of the New Synthesis, I believe it pertinent to ask how Mayr’s approach to Australian bird origins may have been influenced by Simpson’s work specifically and the climate of evolutionary study, which he was helping to shape, generally. The answer seems clear in his use of the term "colonization of Australia by birds" in the title of a paper (Mayr 1944a). Gentilli (1949:98) even spoke of birds having reached Australia in relatively recent geological times. This indicates how trenchant the idea was in the 1940s that Australia had to have been colonized by birds from elsewhere. Evidently, it was untenable and not worthy of discussion to think that birds could have been in Australia all along. Mayr (1944a,b) developed the hypothesis that Australia's birds had been derived by successive waves of invasion from Asia through Indonesia. Earlier waves, he argued, had led to longer periods of evolution in isolation and therefore to the evolution of distinctive families like megapodes. Later waves resulted in the forms that he considered close to Asiatic groups. Among these he cited the Square-tailed Kite (*Lophoictinia isura*), paradise kingfishers (*Tanysiptera* spp.), and treecreepers (*Climacteris* and *Cormobates* spp.), to name a few. Years later, Mayr still spoke of Australia receiving its avifauna from Asia (Mayr 1972).

In the 1940s, many of Australia's birds were still considered closely related to their Northern Hemisphere ecological counterparts: sittellas were thought close to nuthatches, for example. Also critical here is that continental drift, vehemently denied by Mayr (1944a,b), was far from accepted. To a dispersalist biogeographer in 1944 intimately familiar with the theory of the Great American Interchange, that is, Ernst Mayr, the physical arrangement of Asia and Australia with the Indonesian archipelago between them must have been tantalizingly similar to North and South America with Central America between them. All of this could easily have encouraged the Sherwin-Williams Effect. I submit that it is in a context such as this that one should today view Mayr's (1944a,b) hypothesis of the origins of Australia's birds. Inherent also in his view is that perceived levels of morphological divergence are proportional to time elapsed since divergence from a common ancestor. While intuitively reasonable, this concept has been questioned repeatedly with perspectives from molecular data. To appreciate this quickly, think of the morphological uniformity of crows and ravens (*Corvus* spp.) worldwide relative to the diversity of a single group such as ringneck parrots (*Barnardius* spp.).

Knowledge of the higher systematics and origins of Australian birds stayed largely where Mayr (1944a,b) left it until the 1960s and 1970s. As continental drift became undeniable, however, the hypothesis that many Australian birds were autochthonous, that is, had evolved in Australia, took root. Important then and in the coming years were new discoveries in Australia of fossils and fossil traces of birds ranging from Cretaceous feathers, late Tertiary and Pleistocene footprints (Talent et al. 1966, Waldeman 1970, van Tets 1974), the first Southern Hemisphere passerine (Boles 1995), and the "magnificent" dromornithids or mihirungs (Murray and Vickers-Rich 2003, Olson 1985). Reanalyses of earlier data (Keast 1981a,b) and research that explicitly linked emerging details of continental drift to avian biogeography (Cracraft 1972, 1973, Marchant 1972, Rich 1975a,b, 1976, Rich and Baird 1986, Rich and Green 1974, Serventy 1972a) were also important in developing the notion that Australian birds had evolved in Australia. Nonetheless, even with the reality of continental drift admitted, there was reluctance to relinquish earlier views of the role of dispersal from Asia; with 20-20 hindsight this reluctance seems nothing short of dogged (e.g., Harrison 1973, Mayr 1972). That same hindsight now suggests to us the enormity of the change that was just around the corner (*cf* Cracraft 1972). To at least this ornithologist growing up at that time, the formidable body of palaeontological work by a North American who has long been based in Australia, Patricia Vickers-Rich, alone and with colleagues (cited above), has led the way in understanding the fossil history of non-passerine Australian birds.

For Australia's passerine birds, fresh assessments of their origins appeared as the use of molecular tools grew. Work was again dominated by North Americans, initially by Charles Sibley, whose interests by then were centred squarely in *all* higher avian systematics. Working first with egg-white proteins (Sibley 1970, 1974), Sibley amassed data on the relationships of the world's birds. In the published version of his paper at the 1974 International Ornithological Congress in Canberra, Sibley boldly listed as probabilities and possibilities hypotheses such as woodswallows being closely related to the butcherbirds, or treecreepers and logrunners having evolved in Australia with no close affinities to birds elsewhere (Sibley 1976a,b but *cf* Mayr 1972, Cracraft 1972).

In the mid-late 1970s, Sibley and his long-time collaborator Jon Ahlquist switched from egg-white protein electrophoresis to the then revolutionary technique of DNA-DNA hybridization. In a steady stream of papers, they addressed many taxonomically difficult birds from around the world. Notwithstanding their controversial data analyses (see Lewin 1988), they unleashed a paper in 1985 that changed forever the way we think about the origins and relationships of Australian passerines (Sibley and Ahlquist 1985). That paper crystallized some of the probabilities and possibilities Sibley (1976a,b) had expressed a decade earlier. It unmasked massive convergent evolution between Australia's and Eurasia's passerine birds that had misled systematists and ecologists alike for years. It revealed that Australia's passerine bird fauna is dominated by very old autochthonous elements not particularly closely related to Northern Hemisphere ecological counterparts. In short, the endemic Australian passerines are as Australian as kangaroos and gum trees and evolutionarily "as old as the hills." It is worth stressing how late this view arrived—1985!

Sibley and Ahlquist (1990) rekindled world-wide interest in higher avian systematics generally. They set the scene for rebuilding ideas concerning the origins of passerines, in particular the oscines. Research that followed by others tested Sibley and Ahlquist's hypotheses variously reinforcing or substantially modifying their work. Important to note here was palaeontological work of Boles (1991, 1993, 1995, 1997), molecular work of Christidis and Schodde (1991a) and a remarkable series of papers using phylogenetic analysis of DNA sequences from nuclear and mitochondrial DNA (mtDNA) genes: Barker et al. (2002, 2004) and Ericson et al. (2002). Those three papers, aside from being fine examples of current approaches to higher avian systematics, have brought higher systematics of Australian passerines to its current level. Other papers from this period maintained interest in higher systematics of non-passerines with molecular, chromosomal, and morphological tools (e.g., Amadon 1978, Christidis et al. 1991a,b, Olson and Feduccia 1980, Smith 1975).

I conclude this section by noting that Sibley and Ahlquist's body of work also was the main stimulus for renewed interest in the evolutionary history and significance to avian biology generally of one of the most prominent features of Australian passerine biology, co-operative breeding (see Boland and Cockburn 2002, Cockburn 2003, Russell 1989, Edwards and Naeem 1993).

LOWER SYSTEMATICS AND BIOGEOGRAPHY FROM 1951-2000: THE BROAD-BRUSH BACKGROUND

Here I examine how avian systematists used the study of geographical variation within a species to revise taxonomy and then develop hypotheses of phylogeny and biogeography. We will see that that sequence has recently tended to reverse and the merits or otherwise of that will be discussed. We will also see how the field known as phylogeography forms a bridge between systematics and population genetics. I begin with a closer look at why Australian avian systematists were drawn to questions of species and subspecies limits for much of the 20th century.

Taxonomy and nomenclature.—Emphasis on species and subspecies limits in taxonomy grew from several sources. By the 1950s and 1960s, RAOU (1926) was an outmoded, unhelpful summary list of Australian birds and their distributions. The many thorny taxonomic issues surrounding individual species and species-groups were obvious choices for study. An example was the complex pattern of geographical variation shown by the Brown Thornbill (*Acanthiza pusilla*)/Inland Thornbill (*Acanthiza apicalis*) complex (Mayr and Serventy 1938, Boles 1983). Also, the subspecies concept had a profound impact in ornithology (Barrow 1998). That Wilson and Brown (1953) had stridently dismissed its merit on the grounds that *external phenotype alone* could not possibly reflect all the genetic data that bear on the evolutionary history of a species seemed not to greatly impact ornithology. Almost alone among systematic biologists, avian systematists stuck to the subspecies concept. Perhaps this reflected its use in describing geographical variation. Ornithologists did, however, regularly and vehemently debate its merits (e.g., Wiens 1982 and accompanying 11 papers, Zink 2004) and review its various forms and their application (for Australian example see Ford 1974a). Lastly, there was the impact of what became known as Mayr's evolutionary systematics rooted as it was in the Biological Species Concept (BSC) and the New Synthesis itself (Mayr 1942).

A protocol for studying species and subspecies limits thus grew out of Mayr's evolutionary systematics and dominated much of the latter half of the 20th century. Under the BSC, its central question was whether two populations are reproductively isolated. Reproductive isolation of the populations would be indicated by complete overlap of current geographical ranges (sympatry) with hybridization and intergradation effectively absent; their status as species would be inferred. If two populations were deemed not reproductively isolated, then subspecies limits would be addressed. This was done by asking whether geographical intergradation between the populations was "secondary" or "primary" (e.g., Wooller et al. 1985 in their study of the Singing Honeyeater [*Lichenostomus virescens*]). Secondary contact meant that differentiation had arisen in previously isolated subpopulations that have since come into contact due to geographical range expansion; thus they are not reproductively isolated and so involve subspecies of one species. Primary contact meant that no past isolation was inferred and that the variation would have evolved entirely through natural selection *in situ* as a response to environmental gradients; thus only one species and no subspecies were involved. Key papers by Short (1969) and, in Australia, Ford (1974a) formulated an oft-used approach to define the extent and character of intergradation. Zones of geographical intergradation were examined for whether they were gradual and broad, which was interpreted to suggest primary contact, or sharp and narrow (secondary). It would determine whether zones of intergradation have only phenotypic intergrades (suggesting reproductive isolation not achieved and only subspecies involved) or intergrades and parental phenotypes present (suggesting origins of reproductive isolation and sympatry and that two species are involved).

So, attention was naturally directed to where closely related populations came into geographical contact (e.g., Short et al. 1983a,b) and papers on individual species burgeoned from the 1950s onwards. For brevity and tribute, I single out Julian Ford's (1932-1987) work here. He saw study of hybridization and intergradation as fundamental to improved understanding of speciation and taxonomic species limits. He built a major program of research into hybridization in Australian birds (see Ford 1974a, 1975, 1979, 1987a,b for summaries). His work joined that of Short (1969) on the world stage for its significance of the role of hybridization to speciation. Overall, this period saw many individual taxonomic studies on which annotated checklists were based. They brought much order to what was known of species limits, taxonomy, and distribution of Australian birds. Dominant players in terms of single-authored research output were H. T. Condon, J. R. Ford, J. A. Keast, E. Mayr, D. L. Serventy, S. A. Parker, and R. Schodde. Others, some of whom are not specifically cited elsewhere in this review (see papers marked with an asterisk * in Literature Cited), however, made important contributions even if in only one or two papers: A. B. Black, W. E. Boles, A. J. Cain, M. Clench, J. B. Cox, F. Crome, C. T. Fisher, C. and D. Frith, I. C. J. Galbraith, C. J. O. Harrison, K. A. Hindwood, M. Heads, C. J. O. Harrison, D. T Holyoak, D. Horton, J. Hughes, R. Johnstone, N. W. Longmore, J. D. MacDonald, I. J. Mason, and G. F Mees. *The Handbook of Australian, New Zealand and Antarctic Birds* (e.g., Higgins and Peter 2002) has also made many important contributions in its accounts of geographical variation and systematics. Refreshingly, workers who were not primarily systematists brought other and occasionally controversial perspectives to the fray (e.g., H. Ford 1981; Rowley 1967; Saunders 1974, 1979) and some even hinted at the links between population genetics and systematics (Burton and Martin 1976, Hughes 1982, Woinarski et al. 1983) that would later be formalized as phylogeography (Avise 2000, Avise et al. 1987).

Eventually, debates over species and subspecies limits morphed to some extent into debates about which of several currently popular species concepts such as the Phylogenetic Species Concept should be applied, a subject discussed at length elsewhere (Otte and Endler 1989, Wheeler and Meier 2000). It is pertinent for this review to note that Schodde and Mason (1999) introduced into Australian avian systematics an entirely new taxonomic rank, the ultrataxon (plural ultrataxa). What would be considered under the BSC as a monotypic species on one hand and a subspecies of a polytypic species on the other would have the same taxonomic rank of ultrataxon; only the subspecies comprising a polytypic species, not the species itself, would be ultrataxa. I submit that the ultrataxon concept acknowledges the operational simplicity and key points of the Phylogenetic Species Concept while adhering to the use of trinomials permitted under the BSC. The point here, however, is that the generation of Australian avian systematists from the 1950s to the 1980s worked largely under the theoretical umbrella of Mayr's evolutionary systematics and the BSC.

Some other facets of this era are worth noting. Particular taxonomic pre-occupations and methodologies of these systematists and their advocacy of specimen-collecting were often maligned by non-systematists as academic at best and non-scientific at worst (see discussion in Serventy 1972b). Debates of this nature occasionally flared in venues such as newsletters of regional ornithological associations. Ingram

(1977) and Schodde (1981a) were parts of such a debate and another example surrounded publication of Parker et al. (1978). Also, much of this part of the 20th century's avian systematics clarified units of what is now so often simplistically labelled "biodiversity." It laid an extraordinary foundation upon which young turks like this author can design molecular work on Australian birds at all taxonomic levels. That this generation of workers also constructed phylogenetic and biogeographic hypotheses, as systematists should, leads to the next subject: getting from taxonomy to phylogeny and biogeography.

Phylogeny.—I have reasoned that Mayr's evolutionary systematics provided the theoretical umbrella for taxonomic study of species and subspecies limits. It was another thing altogether to formulate and test phylogenetic and biogeographic hypotheses derived from that taxonomy. Nonetheless, Australian avian systematists routinely inferred phylogenetic relationships from their taxonomy. Speculation and intuition were unfortunately often the most robust tools with which they had to work in analysing what we would today regard as an essentially low number of characters available from plumage and morphometrics (see Schodde and Mason 1999 for characters of internal anatomy). They usually expressed the shape of inferred phylogenetic trees verbally not diagrammatically with statistical support measures, as is customary today. The lack of an explicitly repeatable methodology for generating phylogenetic hypotheses and their taxonomic expression did not enhance the way avian systematics was seen by non-systematists and even by some vertebrate systematists in the 1970s and 1980s (e.g., Ingram 1977). No algorithms or formulae were used so this body of work is certainly open to the criticism that it is not repeatable. With so few characters, one might counter that repeatable algorithms and formulae are not needed but that in turn questions how robust the work was anyway. I do so dispassionately with no intention of disparaging the work, especially as it underlies so much of my own work.

As an example, consider how the conclusions of a taxonomic study can be expressed as phylogenetic hypotheses to be tested by independent means. A taxonomic conclusion under the BSC may be that A and B are subspecies because they hybridize and intergrade. A common phylogenetic inference from evolutionary systematics, and this next point cannot be stressed enough, is that based on this *and perceived overall similarity* they must therefore be more closely related to each other than either is to C. This *may or may not be the case*, hybridization notwithstanding. Further, if one allows for variable rates of evolution in morphological characters, it is all the more difficult for the BSC to guide a decision when the populations in question are geographically isolated from each other. Development of alternative theoretical frameworks and methodologies let alone species concepts were, in retrospect, inevitable. They came in the 1960s and 1970s with cladistics, sometimes called phylogenetic systematics, and the advent of molecular characters and computer-based algorithms for repeatable phylogenetic analyses of data under various criteria such as parsimony, maximum-likelihood and Bayes' Theorem (originally published by Bayes 1764!).

Originally published in German by Willi Hennig, the theory of cladistics permeated the English-speaking world with Hennig (1966). Hennig introduced cladograms, which diagrammatically show a hypothesized branching pattern of relationships among the taxa in question derived by a specific methodology that he also introduced. Alternative hypotheses can be shown as alternative branching patterns or cladogram "topologies" and they can be tested. Hennig's philosophy of systematics relied not on perceived overall similarity, but more on understanding the direction of evolutionary change for each character studied. For example, two parrots we call rosellas should be united taxonomically in a single species or in a genus only if they share one or more features (formally, character states, such as mottled dorsal pattern, of a given character, dorsal pattern), which we can argue were derived since these rosellas diverged from *their* most recent common ancestor. Critically, these would be distinguished from features retained from the common ancestor of all the members of the broader group of parrots to which rosellas belong, which includes the *Psephotus* and ringneck parrots *Barnardius* spp. Those features would be part of perceived overall similarity retained from a more distant ancestor than the most recent common ancestor of the two rosellas in the example. Indeed, the very ability of two taxa to hybridize may indicate only that they have retained enough genetic material to do so from a relatively distant ancestor, that is, not their most recent common ancestor. Hybridization between a rosella and, say, a *Psephotus* parrot, or between a Chestnut-breasted Quail-thrush (*Cinclosoma castaneothorax castaneothorax*) and Cinnamon Quail-thrush (*C. cinnamomeum*) need not in itself mean that the hybridizing taxa are more closely related to each other than to another such as ringneck parrots or the Western Quail-thrush (*C. casta-*

neothorax marginatum), respectively. In the context of this review, it is important to note that Oliver (1945) in the published version of his 1944 *RAOU* Presidential Address, presaged modern cladistic approaches to systematics and biogeography when he wrote: "In order to make a natural classification or construct a phylogenetic tree it is necessary to know the direction in which the individual as a whole or the separate organs change." Note also that Oliver used the term "phylogenetic tree," which reminds us that, aside from use of the term "phylogeny" for more than a hundred years in biology anyway, the concept of a phylogenetic tree is far from new, even in the corner of the biological world being discussed here.

Nothing has been the same since Hennig (1966). Felsenstein (2001) noted: "Phylogenetic systematists found themselves trying to dislodge a dominant school of evolutionary systematists who would not make their methods explicit and algorithmic. The phylogenetic systematists responded with an increasing stridency" (see Felsenstein 2001 for more of that debate's history). Here we need only note that statistically supported phylogenetic trees showing the extent and direction of character evolution are now the most common language in which all available kinds of character-rich data, especially DNA sequences, are used to describe results of phylogenetic analyses. These analyses are done not only with cladistics, but with algorithms of maximum parsimony (cladistics), maximum likelihood, Bayes' theorem, and neighbor-joining. These are all implemented by readily available software packages. DNA sequences now provide an abundance of characters for analysis by these packages, but of course the DNA sequences mean little without knowledge of variation in the birds themselves that carry the DNA. Thus DNA work builds on earlier morphological work and relates importantly to it. That is as it should be at the beginning of the 21st century.

Biogeography.—Historical biogeography, for its part, also underwent radical change. For much of the first half of the 20th century, the dominant paradigm in historical biogeography was dispersal (Darlington 1957). This could explain the origin of any present-day distribution pattern, but, alas, was virtually impossible to test. Its early, trenchant position in Australian ornithology can be seen in Hall (1901), who discussed the evolution of Red-capped Robins (*Petroica gooden-*

ovii) not 50 years after the publication of the *Origin of Species* (Darwin 1859):

> "It had occurred to me, judging by the known distribution of the two species [that he was discussing], that when the Red-capped Robins started from Cape York Peninsula to populate our continent, the red-throated parent went due west and had to stop at a little beyond the Fitzroy River owing to geographical barriers; and that the black-throated part went due south as far as Victoria, then west to Albany, WA . . . ."

Today we would ask: why did Hall suppose that the dispersal began in Cape York Peninsula? Did he suppose the continent to have been *Petroica*-less and that Red-capped Robins colonized the continent by waves of invasion? Where are the data and repeatable analyses of that data to support these conclusions? Clearly, Hall worked under the phylogenetic and biogeographic paradigms of his day (as we mostly all do, I suppose). Continents were thought to be static and Australian passerines were thought closely related to their ecological counterparts in the Northern Hemisphere as already discussed, and dispersal was the way to explain any distribution pattern.

Given dispersal's dominance in biogeography in the first half of the 20th century, I submit that Australian avian biogeography from 1950 onwards was poised for a paper by Gentilli (1949) to have far-reaching effects. A geographer by profession, Gentilli (1949) introduced powerful language and images from meteorology. For example, he hypothesized a phase in the evolution of ringneck parrots (*Barnardius*) involving "fronts" of dispersal and "invasions" across the continent. These he depicted in most unsubtle maps using the same symbols that meteorologists use for cold or warm fronts (Figure 4). I ask: how must Gentilli's paper have influenced the up-and-coming generation of Australian workers in the 1950s? Probably as much as their writings over the next 30 years influenced the likes of me. But whether intended or not, an impression can justifiably be obtained from Gentilli (1949) of waves of ancestral bird populations moving across the continent like an avian equivalent of a front of grasshopper nymphs eating their way across a landscape, albeit slowed in time and spread over a greater space. Gentilli (1949) also brought to Australian avian biogeography part of a then emerging awareness of how heightened late Pleistocene aridity shaped present-day distributions of the Australian biota. In this he was

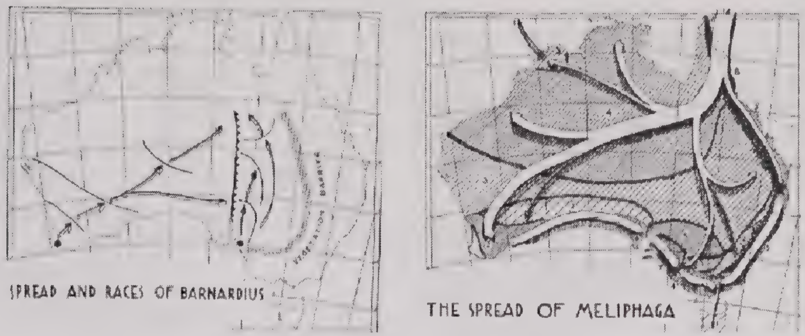


Figure 4. Some typically unsubtle diagrams from Gentilli's (1949) landmark paper.

surely influenced by botanists Crocker and Wood (1947) and their pioneering analysis of the origins of South Australian vegetation.

And yet, at that very time—mid-century—Australian avian biogeography was also poised to soak up the opposing influence of Mayr's theory of allopatric speciation and vicariance, the biogeographical opposite of dispersal. The literature of Australian avian biogeography, I submit, shows something of an intellectual tug-of-war between these opposing paradigms of dispersal and allopatric speciation/vicariance. Numerical analyses of Kikkawa et al. (1981) and Kikkawa and Pearse (1969) attempted to pinpoint where dispersal was needed by some kind of repeatable analysis. Overall, however, the language of Australian avian biogeography was freely and heavily couched in dispersalism until well into the 1980s even though vicariance and refuge theory bubbled away loudly underneath it. Examples abound: adaptational pathway and waves of east-west colonization (Keast 1961:441, 429), continuous adaptive flow (Schodde 1982:204), a species "recrossed" a barrier, and "pathways to speciation" (Ford 1974b). The point here is not to criticize or dismiss the use of dispersalist language, but to recognize that vicariance and dispersal were both being used and that the challenge is to test the hypotheses so generated.

Just as cladistics revolutionized phylogenetics, so too it revolutionized biogeography. By the late 1970s, continental drift was accepted and biogeographers started to think in terms of the evolutionary histories of whole regions such as continents. They cladistically analysed relationships in several different groups of species sharing the same distributions. They would then look for what those histories had in common by deriving a phylogenetic tree of the *areas* inhabited by the species under study. Thus they would estimate the history of the areas themselves. This was area or cladistic biogeography (e.g., Nelson and Platnick 1981) and its dominant paradigm was vicariance, the splitting of ancestral species distributions by some major environmental phenomenon such as separation of continents, uplift of mountains, development of rivers, and so on. Thus, cladistics underlay the replacement of dispersal by vicariance as the dominant paradigm or null hypothesis in historical biogeography (see Zink et al. 2000 for further discussion)

The advent of cladistics and cladistic biogeography placed within reach the goal of intertwining phylogeny and biogeography that had always been inherent in the work of systematics. Perhaps more importantly, it established as routine the first of several repeatable methodologies for doing so. The trend continued in the late 1970s and on into the 1990s when molecular data, particularly DNA sequences, could be studied. A key development from molecular work at lower taxonomic levels has been phylogeography, described as a bridge between population genetics and systematics (Avise et al. 1987, Avise 2000). Phylogeography examines the principles and processes that determine the geographical distribution of genetic lineages within a species. Again, this is not a new goal of systematists. It is having data that can be subjected to repeatable methodologies for integrating genetic diversity and geographic distributions to achieve that goal that is new.

LOWER SYSTEMATICS AND BIOGEOGRAPHY FROM 1951-2000: A CLOSER LOOK

Though some examples have been cited, I now look more closely at how Australian avian systematics and biogeography mirrored the worldwide developments discussed above. Choice of examples undoubtedly reflects my own interests, experience and biases, but I hope they do justice to those on whose work I too try to build.

The body of work by J. A. Keast, rooted firmly in Mayr's evolutionary systematics, is arguably a cornerstone of modern Australian avian systematics and biogeography. In the 1950s, Keast produced an impressive series of taxonomic papers while based at the Australian Museum, Sydney, on species limits in a diverse range of Australian birds (e.g., Keast 1957, 1958a,b and references in Blakers et al. 1984, and Schodde and Mason 1999). These often included hypothesized biogeographical histories. An example is his analysis of whipbird *Psophodes* spp. evolution (Keast 1958b) in which vicariance and dispersal are freely invoked to explain present-day distributions. His later doctoral work under Ernst Mayr's supervision on bird speciation in Australia (Keast 1961) was seminal. It synthetically reviewed species limits of Australian birds and suggested the diversity of speciation mechanisms that produced them. Keast later focussed, though not exclusively, on adaptive evolution, comparative evolution on the southern continents, and physiology (Keast 1959, 1968, 1972, 1976a,b,c, 1994) rather than Australian and New Guinean avian systematics and historical biogeography *sensu stricto* to which he nonetheless has continued to contribute (Keast 1977, 1978).

Building on Keast's foundation, J. R. Ford, S. A. Parker, and R. Schodde dominated much of later 20th century Australian avian systematics. Shane Parker's work was often most concerned with taxonomy and nomenclature rather than phylogeny and biogeography, a point he made unapologetically explicit in work on bronze-cuckoos (*Chalcites* spp.) (Parker 1981; but see Parker 1970). Fine examples of his scholarship were his meticulous unravelling of taxonomic and nomenclatural disorder surrounding the Thick-billed (*Amytornis textilis*) and Dusky (*A. purnelli*) grasswrens, respectively (Parker 1972), his demonstrations that two Australian birds, Brown-tailed Flycatcher (*Microeca brunneicauda*) and Charleville Scrubwren (*Sericornis tyrannulus*) do not exist (Parker 1973, 1984), and even brief forays into higher systematics and adaptive anatomical evolution (Parker 1982a,b). Ford and Schodde, on the other hand, freely used their taxonomic work on individual species to generate phylogenetic and biogeographic hypotheses. They invoked vicariance and dispersal, but relied heavily on the language of dispersalist biogeography typical of the school of Mayrian evolutionary systematics.

Julian Ford produced a staggering body of work before he died in 1986 including an impressive series of papers resulting from one lengthy field trip in 1976 (see *Emu* 1977-1986). We have seen already that he focussed on hybrid zones and hybridization (Ford 1987a,b). He also wrote landmark papers on subspecies concepts in Australian ornithology (Ford 1974a), on speciation in arid zone and mangrove birds (Ford 1974b, 1982), and conducted superb species-level revisions

(Ford 1981a,b,c, 1983a,b, 1986). It was Julian Ford who first used a recognizably modern systematics protocol in Australian ornithology to construct trees in a paper on quail-thrush systematics (Ford 1983b). For the first time, data were presented in a matrix with names of birds in the left margin, the characters examined across the top, and the data in the body of the table. The data were analysed using different, repeatable computer-based algorithms to produce tree diagrams that were offered as phylogenetic hypotheses, though strictly they are summaries of genetic distances not truly phylogenetic hypotheses.

Similarly, Richard Schodde, often with Ian Mason, has done many revisionary taxonomic studies (e.g., Schodde and Mason 1976, 1980, 1997, 1999, Schodde et al. 1980). His work has long been characterized by inclusion of phylogenetic and biogeographic hypotheses. Examples cover acanthizids, birds-of-paradise, problematic monotypic passerine genera, and the Maluridae (Schodde 1975, 1976, Schodde and McKean 1976, Schodde and Weatherly 1982, respectively). He has authored several major biogeographic reviews (Schodde 1981b, 1982, 2006) and addressed more strictly nomenclatural issues (Schodde 1978a). Two papers in particular, however, I suggest are especially significant contributions to the body of hypotheses to be tested in Australian avian biogeography. One is a biogeographical analysis with J. Calaby of eastern Australian and New Guinean rainforests (Schodde and Calaby 1972). This argued that the systematics and historical biogeographies of the Australian and New Guinean biota, which had so often been discussed separately, should be considered as parts of one greater subject (see also Brereton and Kikkawa 1963). The paper developed the further insight that the biota of tropical and subtropical montane rainforests of eastern Australia and New Guinea should be recognized as belonging to a single, albeit disjunct, biogeographical province, the Tumbunan Province. Recognition of the Tumbunan province and indeed Schodde's (1978b) later recognition of the Irian Province in northern Australia and southern New Guinea were major modifications to the still used biogeographic divisions of Australia introduced by Spencer (1896). Tumbunan rainforests were argued to have been an evolutionary source for much of the biota of more arid Australia. DNA sequence data from honeyeaters (Meliphagidae) suggest that understanding the possibly more idiosyncratic-than-expected histories of different groups will be important in fully testing these biogeographical hypotheses (Driskell and Christidis 2004). The second paper picks up this thread in its thorough review of

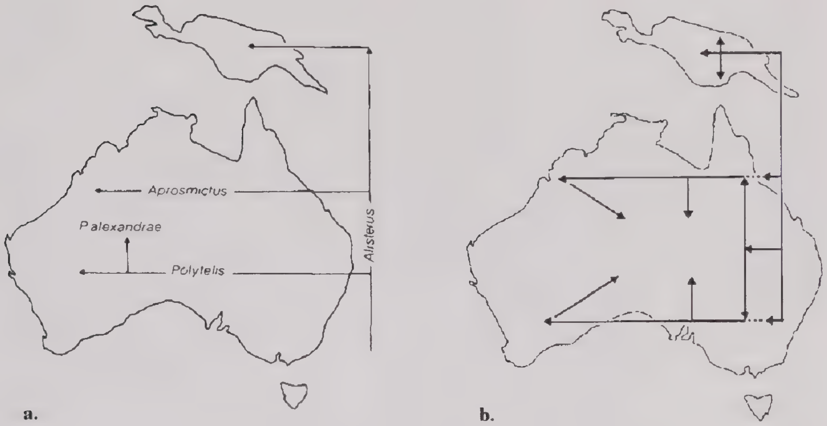


Figure 5. Two “diagrammatic outlines” from Schodde's (1982) paper on the evolution of the arid zone avifauna. Figure 5a. Hypothesized evolution of the polytelitine parrots. Figure 5b. A summary hypothesis for evolution of the arid zone avifauna.

the biology and evolution of the Australian arid zone avifauna (Schodde 1982). There Schodde concluded that the arid zone avifauna had been built up by a “train of adaptive shifts,” the sequence of which began in subtropical, Tumbunan rainforests along coastal eastern Australia, entered the sclerophyllous vegetation of northern and south-eastern Australia, split, and ran west and east on either side of the central arid zone towards south-western and north-western Australia. It finally turned into the arid zone from both directions. Importantly, this paper also heralded for Australian ornithology the coming phylogenetic tree-based era, just preceding Ford’s (1983b) paper mentioned above. It offered many “diagrammatic models, not literal outlines” of avian evolution in the arid zone. An example is Figure 5 for the polytelitine or long-tailed parrots. Although these outlines are not phylogenetic trees derived by repeatable methodologies (nor were they offered as such; *cf* Felsenstein 2001), it is important here to reiterate that the paper is rich in testable hypotheses. It will be obvious that I was struck by the dispersalist language in which these often vicariance-based hypotheses were crafted. I might even argue that that language was a little over-played. Indeed, the risk is there that the paper could be mis-interpreted as suggesting that ancestors of many of the arid zone’s present birds, apart from exceptions Schodde noted (water birds, some specific land birds), populated the continent's otherwise bird-less interior in a Gentillian "flow" inward from the periphery only *after* arid zone vegetation had first evolved. This would miss the point that the paper offers a key hypothesis for testing: that the evolution of the arid zone fauna involved adaptation from wetter mesic environments to drier, xeric ones, a point Schodde (1989) clarified. Again, what is important is that these are hypotheses for which testing is still preliminary (see Couper et al. 2000 for leaf-tailed geckoes *Phyllurus* spp. and their relatives and Driskell and Christidis 2004 for birds).

Not surprisingly, evolution of the Australian arid zone avifauna has thus been a testing ground for different approaches to phylogeny and biogeography. As is healthy in science, different authors occasionally produced diametrically opposed hypotheses about the same birds. That this happened is not a problem. The point is that tests of these alternative hypotheses could not be done until late in the 20th century (and often still have not been done) when independent sources of data, new ways of thinking and new methods of data analysis were available. Three examples follow.

First, Schodde's (1982) hypotheses for the arid zone can be compared to and tested against those of Cracraft (1986), who brought cladistic biogeography to Australian ornithology. Based on morphology, he first built trees for different groups of birds with essentially the same geographical distributions. Then, those trees were synthesized into a single tree describing the evolutionary history of the areas in which those birds occur. Cracraft had some key areas of difference and agreement with Schodde's (1982) earlier analysis. To the extent that Cracraft (1986) saw the ultimate origins of arid zone birds in the wetter periphery of the continent, he agreed with Schodde (1982). He differed, however, in arguing a greater extent to which isolation of ancestral stocks had occurred *in situ* in the arid zone through vicariance (see also Kikkawa and Pearse 1969). It was not feasible, he argued, to invoke an essentially dispersalist origin from wetter areas for group after group and arrive at the present day distributions of birds. I note, here, that vicariance has nonetheless been a major plank of much of Schodde's work.

Second and third, Ford (1981b) and Schodde (1982) both hypothesized different biogeographical histories for *Amytornis* grasswrens and the Western Gerygone (*Gerygone fusca*). For grasswrens, one author argued origins in the centre of the continent with evolution outwards to the periphery, whereas the other espoused the opposite view (see Christidis 1999). With *G. fusca*, the authors hypothesized alternative pathways of dispersal across the continent and these remain untested.

McLennan and Brooks (2002) picked up conceptually where Cracraft (1986) left off and provided another milestone in Australian avian biogeography. Working with repeatable algorithms of data analysis, they derived hypotheses that postulated specific dispersal and extinction events in the histories of several groups of birds. Lamentably, they cited no Australian ornithological literature earlier than Cracraft (1986), and so ignored important contributions of Keast, Ford, and Schodde, among others.

ADVENT OF MOLECULAR TOOLS

The advent of molecular and biochemical data in Australian avian systematics and biogeography began in the 1980s. Initially, relevant research on Australian birds involved chromosomes, allozymes, and immunology, and examined lower and higher level issues (Adams et al. 1984; Joseph and Hope 1984; Christidis 1986a,b, 1987a,b; Schodde and Christidis 1987; Baverstock et al. 1991, 1992; Christidis and Schodde 1991a,b, 1997).

Allozymes were the most commonly used molecular tool at this time. Like the DNA-DNA hybridization that Sibley and Ahlquist had used, they generate measures of genetic distance between the taxa under study. Trees of inferred relationships made with these tools essentially summarize genetic distances between taxa and are not estimates of truly phylogenetic relationships. Allozymes also measure genetic diversity within, and reproductive isolation between, populations.

The advent of methods to directly access DNA was the next major technical development. Systematics in the last 20 years has seen nothing short of a revolution in how phylogenetic trees are constructed in terms of both the data and methods of analyses. Routinely, the data are now DNA sequences of which every letter or base pair is a character with inherent phylogenetic information as well as the basis for measuring genetic distance. Computers process the amount of data involved and, increasingly, include in the analyses a model of how DNA sequences themselves evolve. For these kinds of reasons, we can now speak of statistical phylogenetics (Felsenstein 2001). Trees based on the phylogenetic information in DNA sequences are truly phylogenetic (*cf* over-zealous use of DNA-based distances in Penhallurick and Wink 2004). DNA can also be extracted from museum specimens of extinct and rare birds.

By the late 1980s and early 1990s, and again mirroring worldwide trends, Australian avian systematics shared in this excitement and had moved to restriction enzyme analysis of DNA and finally direct sequencing of DNA itself, most often mtDNA (Joseph and Moritz 1993a,b, 1994, Joseph et al. 1993, 1995, 1999, Norman et al. 1998, 2007, Ovenden et al. 1987, Sraml et al. 1996). At the time of writing, avian systematists and biogeographers working on Australian, New Guinean, and New Zealand birds have fully embraced DNA sequence-based tools (Abbott and Double 2004, Baker et al. 1995, Boon et al. 2000, 2001, Christidis et al. 1996, Degnan and Moritz 1992, Driskell et al. 2002, 2007, Joseph and Wilke 2006a,b, Joseph et al. 2001, 2002, 2006, Lambert et al. 2002, Rhymer et al. 2004, Shepard and Lambert 2007, Trewick 1997). This includes the extraction of DNA from museum skins (Cooper et al. 2001, Haddrath and Baker 2001, Norman et al. 1998, 2002).

Just as higher level molecular work revealed ecological and morphological convergence of interest to non-systematists, the following examples show the increasingly diverse insights that current studies of lower systematics and biogeography offer study of the biology of Australian birds, especially as the area of overlap between systematics and population genetics known as phylogeography is ever more prominent. All of this work builds on the foundation of systematics and biogeography provided by the systematists discussed above.

Jane Hughes and her colleagues have performed some of the most explicit tests of primary versus secondary differentiation in explaining geographical variation in the Australian Magpie (*Gymnorhina tibicen*) (Hughes et al. 2001, 2002). Included in work led by J. Hughes on this bird has been largely theoretical population genetics analyses of the cline in back colour (Hughes 1982), genetic evidence for long-distance dispersal (Baker et al. 2001), continent-wide molecular phylogeography (Hughes et al. 2001, Toon et al. 2007), and assessments of the fitness of different plumage forms (Hughes et al. 2002). Scott Edwards and his students (based in North America!) studied evolution in the babblers (*Pomatostomus* spp.) and gained insights into the systematic position of Hall's Babbler (*P. halli*) (relationships of species conflicting with earlier plumage-based assessments (Edwards and Wilson 1990), levels of current long-distance dispersal in Grey-crowned Babbler (*P. temporalis*) (Edwards 1993), and deeper demographic history of *P. halli* (Miura and Edwards 2001)). Some of that work has applied what are arguably the most powerful currently available analytical tools of theoretical population genetics, coalescence theory, to their data. Christidis et al. (1988) tested hypotheses of relationships among scrubwrens *Sericornis* spp. that had been developed from plumage (e.g., Galbraith and Parker 1969) and reinterpreted the history of adaptive shifts in the ecology of these birds (see also Joseph and Moritz 1993a). Molecular work on the historical biogeography of eastern Australian and New Guinean rainforest birds has integrated present-day ecology and evolutionary history for several groups (Norman et al. 2002, Joseph et al. 1993, 1995, Joseph and Moritz 1993a,b). Evolution of host specificity in the brood parasitic Horsfield's Bronze-Cuckoo (*Chalcites basalis*) was examined with mtDNA (Joseph et al. 2002). Apart from suggesting long-term variation, not constancy, in hosts used by the cuckoo, that work suggested that the species has expanded throughout much of its geographical range since the aridity of the Last Glacial Maximum at 18,000 y ago ameliorated. This provided the first molecular test of ideas tracing back to Crocker and Wood (1947), Gentilli (1949), and Schodde (1982). Interestingly, it brings full circle the role of dispersal in the historical biogeography of Australian birds, at least to its role in the Late Pleistocene (see also Avise and Walker 1998 for discussion of the Late Pleistocene on present-day genetic architecture of bird species).

The relative ease of doing molecular systematics today has tended to reverse the paradigm of "begin with geographical variation to understand taxonomy and then think about phylogeny" that dominated much of the 20th century. It is equally important to acknowledge that this reversal could not happen without the foundation of work by the avian systematists I have discussed. Relative to most systematic biologists, avian systematists working at lower levels should remember that their predecessors have left a body of basic taxonomy upon which they can build. They should also note that the development of different species concepts also facilitates this phylogeny-first approach.

SOUTH-WESTERN AUSTRALIA AS A TESTING GROUND FOR THE FUTURE

Here I try to illustrate key points of this review by way of reference to some long-standing problems on the systematics and biogeography of the birds of south-western Western Australia. Literature on the subject provides a firm foundation rich in hypotheses generated from Mayrian evolutionary systematics and dispersalist biogeography to be tested against alternative systematic philosophies with modern molecular tools. The examples thus encapsulate the history of many of the ideas discussed in this review and the potential for fresh approaches. I hope that these examples highlight the potentially bright future that Australian avian systematics and biogeography should have.

White-tailed black-cockatoos.—Having established that short-billed and long-billed white-tailed black-cockatoos in south-western Western Australia are taxonomically distinct populations, Saunders (1974, 1979) addressed their systematics on the Mayrian basis of perceived overall similarity. The short-billed birds, he argued, are best regarded as a western subspecies of the otherwise eastern Australian Yellow-tailed Black-Cockatoo *C. funereus*. He treated them as Carnaby's or Short-billed Black-Cockatoo (*C. f. latirostris*) and long-billed birds as a separate species, Baudin's or Long-billed Black-Cockatoo (*C. baudinii)*. With that systematic hypothesis in place, Saunders postulated that an originally widespread ancestral stock was isolated in Western Australia. This led first to the evolution of *C. baudinii*. That would have been followed by a later invasion from eastern Australia of yellow-tailed stock that resulted in evolution of *C. f. latirostris*. This predicts the phylogeny shown in Figure 6a. An alternative (Figure 6b) is that *latirostris* and *baudinii* are each other's closest relatives (sister taxa). The similarities between *latirostris* and eastern Australian *funereus* would be retained from the group's common ancestor; their white tails would be a shared derived character indicating they are more closely related to each other than either is to any other black-cockatoo. Molecular characters independent of morphology offer an ideal way to test these two hypotheses. If the hypothesis of Saunders (1979) is statistically favoured over the alternative, then his biogeographical scenario is plausible. If, alternatively, there is more support for the hypothesis that white-tailed forms are sister taxa, then a plausi-

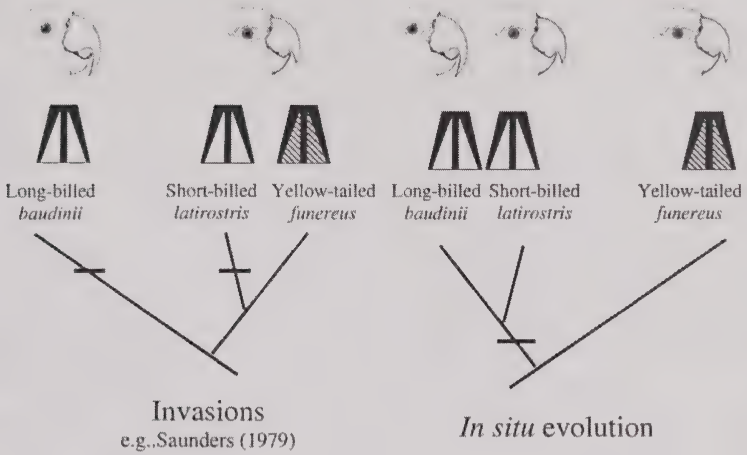


Figure 6 (a, left; b, right). Alternative hypotheses for evolution in the white-tailed black-cockatoos of south-western Western Australia. Instances of the evolution of white tail windows that each hypothesis necessitates are shown with a hatch mark. Heads drawn by J. Pedler, reproduced by permission from H. Ford and Paton (1986).

ble mechanism is needed for them to have diverged from a common ancestor *in situ*. Saunders (1979) noted their largely different breeding distributions so such a mechanism may not be difficult to ascertain. No dispersal mechanisms would be needed to "get" *C. funereus* stock from eastern to western Australia to re-evolve the white tail of *C. f. latirostris*.

Yellow robins.—South-western Western Australia is inhabited by two species of "yellow" robins (*Eopsaltria* spp.), the Western Yellow Robin (*E. griseogularis*) and the White-breasted Robin (*E. georgiana*), which lacks yellow plumage. *E. griseogularis* shares with the Eastern Yellow Robin (*E. australis*) of eastern Australia the presence of yellow in its underparts. Presumably for this reason, coupled with its presence on Eyre Peninsula, South Australia, *E. griseogularis* has been assumed to be more closely related to *E. australis* than to *E. georgiana* (Ford 1971b). This has never been tested against the alternative that *E. griseogularis* and *E. georgiana* are each other's closest relatives and that the yellow underparts in *E. griseogularis*, presumably retained from the group's common ancestor, is of little systematic significance. A biogeographical hypothesis to explain these birds' distributions involves a complicated sequence of vicariance and invasions to and from eastern Australia (Ford 1971b). Simple tests of whether *E. griseogularis* and *E. georgiana* may have diverged *in situ*, and therefore whether invasions need be postulated, remarkably, are still needed. The presence of *E. griseogularis* on Eyre Peninsula still needs explanation and may or may not require invoking dispersal or eustatic changes in sea level.

Notable in these examples has been the automatic inclusion of eastern Australia in the supposed ancestral distribution. This is a reasonable assumption, but I muse whether there this has not been due to some subconscious eastern Australian imperialism or localized Sherwin-Williams effect (see above). More importantly, little or nothing has been done to test it (*cf* Keast 1958b). Tests could involve taxonomically more inclusive phylogenetic analyses of each group to determine whether the western or eastern forms are the oldest. The relict distributions of scrub-birds *Atrichornis* spp. in small parts of eastern and western Australia, for example, must at least hint at the possibility of seriously considering south-western Western Australia as an evolutionary source for birds such as those discussed here (see Crisp and Cook (2005) for caveats about determining ancestral areas). Lastly, I note that ornithologists have not been alone in advocating complicated scenarios of dispersal and vicariance in the evolution of the south-western Western Australia fauna. Molecular systematics of some Australian frogs rejected such theories of invasion of south-western Australia from eastern Australia (Maxson and Roberts 1984, Morgan et al. in press, Roberts and Maxson 1985a,b, 1988, 1989) and have noted that narrow, more subtle geographic barriers than previously considered may have allowed *in situ* speciation (Wardell-Johnson and Roberts 1993). Surely, ornithologists should take note of these studies.

CONCLUSION

The systematics and biogeography of Australian birds have been and should continue to be a microcosm of these fields' evolution on the larger, world stage. The world of systematics especially is now one that is tremendously exciting as ever more powerful DNA-level tools emerge, some of which enable us to look at the entire genome, that is, all the genetic material of an organism (see Gibson 2002, 2005). This will mean that we will achieve better understanding of how selection acts on single genes such as those that affect plumage and how that can be incorporated into knowledge of a species' evolutionary history (MacDougall-Shackleton et al. 2003, Theron et al. 2001). Work on Australian birds is already providing examples (Driskell et al. 2002, Doucet et al. 2004). The value of "traditional" non-molecular methods in avian systematics and biogeography, far from being weakened by modern molecular methods, continues to be in providing critical and complementary perspectives to what is learned from molecular techniques (e.g., Boles 2005, Fulton and Boles 2002). Systematists and biogeographers need to remember that use of all of the available sources of data and methods will keep their research vibrant.

Australian, New Zealand, and New Guinea ornithology, have inherited a geographic and scientific corner of evolutionary biology that should have nothing but a stimulating and productive future. One hopes that training of new students will include a thorough appreciation of the diverse molecular and non-molecular tools that systematics and biogeography offer avian biology and the foundation upon which they have built. I hope, too, that this will include full appreciation of the resources provided by museum collections, which have always underpinned avian systematics and biogeography. Museum collections face difficulties of funding and staffing shortages and probably will continue to do so in the foreseeable future. Aside from ramifications to conservation, this threatens the full integration of systematics, biogeography, and all other aspects of avian biology, regardless of whether one considers collections of dried skins, skeletons, spirit specimens, nests, eggs, or tissue samples for DNA analysis (see Collar et al. 2003 and papers therein). More than ever, systematics provides the historical framework within which the evolutionary history of an organism's biology, including the role of natural selection, can be understood. Co-operative breeding provides a superb example of this. Students of Australian avian systematics and biogeography should continue to be a part of this endeavour and thus part of achieving what has arguably been the broader fields' goals since Darwin (1859): constructing the tree of life. If the reader agrees that systematics and historical biogeography have much to offer the biology of Australian, New Guinean, and New Zealand birds, and that the too familiar image of systematists as crusty, dry individuals operating in equally crusty, dry places away from living birds and the people who study them (Figure 1) should be questioned, then I would consider the review to have achieved some success.

ACKNOWLEDGEMENTS

This chapter is an expanded version of a talk given by the author at the Centenary meeting of *RAOU/Birds Australia*, Adelaide, Friday 2 November 2001. I thank L. Robin, R. Schodde, and W. Longmore and the editors for their comments on a draft. I also thank Dick Schodde for his discussion at that time of the original presentation on some of the ideas that I have elaborated here. I thank the editors for allowing me the opportunity to develop the talk into a chapter for this book. In preparing the chapter I have realised yet again the many debts I owe *all* the Australian avian systematists and biogeographers who have put up with me over the years and for their direct or indirect roles in help with this contribution. I especially thank W. E. Boles, N. W. Longmore, the late J. Ford, J. A. Keast, J. Kikkawa, the late S. A. Parker, and R. Schodde.

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6

Establishing a National Reference Collection of Birds: The First Forty Years of the Birds of the Australian National Wildlife Collection

Richard Schodde[1]

ABSTRACT.—This is the story of the founding of the bird collections of the Australian National Wildlife Collection (ANWC) at CSIRO, Canberra, from the first trickle of specimens in the mid 1950s to the burgeoning of great regional collections from Australia and New Guinea through the 1960s to 1990s. It traces the trials and tribulations so often experienced by wildlife collection managers: vagaries in staffing and support, shortages and successes in storage facilities, the development of broad-based collecting programs with not just taxonomic but also biogeographic and ecological goals, and the ever-present impact of personalities, politics and prejudice. The history is very much a personal one, because in the 1960s I was party to providing the Collection's New Guinean material, and from 1970 to 2000 I served as the foundation Curator-in-Charge, managing the operations of the ANWC and shaping its development. At my retirement, the bird collections, well prepared, comprehensively documented with geographical and biological data and increasingly supported by cryo-frozen tissue for molecular analyses, had become a major heritage record of the Australian bird fauna and one of the largest and most effective anywhere for systematic and zoogeographic research on Australian and New Guinean land and freshwater birds.

No collections, no data
No data, no science
No science, no effective conservation

The Australian National Wildlife Collection (ANWC) is one of four official national biological collections managed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), a monolithic government-affiliated body charged with conducting scientific research in Australia's national interest. The product of mid-twentieth century initiatives, all national biological collections are research-focussed,

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their material serving as the support base for systematic, biogeographic, and natural resource investigation of Australia's biota. Except for the Australian National Fish Collection in Hobart, all are based in Canberra: the Australian National Insect Collection with c. 11 million specimens, the Australian National Herbarium with over 400,000 plant specimens, and the ANWC with today over 120,000 specimens and over 60,000 animal voices covering all vertebrate classes other than fish (for birds, see Gill 2006). Each is autonomous and presently nested in different Divisions of CSIRO. Following moves in late 1996 that could have brought down the ANWC, the then CSIRO Deputy Chief Executive John Radcliffe directed the national collections to form a liaison committee for mutual information-sharing and support. Herein lie seeds for the future germination of an Australian national natural history museum.

I was associated with the Australian National Wildlife Collection from 1960 when I joined CSIRO to 2000 when I retired. It was a period that spanned the first trickle of specimens to the formation of a great national research collection of Australasian birds holding over 40,000 study-skin specimens, as well as extensive anatomical, egg, deep-frozen tissue collections, and recordings of bird calls. As the first Curator-in-Charge, I directed its programs and development for 30 years. This, the chronicle of its early years and focussed on the bird collections, traces its growth through the roller-coaster events affecting its fate as far as the 1990s to the end of the century. It is a story spiced with trial and tribulation as much as achievement, and enlivened by the personalities and politics found in any important endeavour.

A hesitant beginning (1954-early 1960s).—In December 1956, Kent Keith, a technical officer of CSIRO's Wildlife Survey Section skilled in vertebrate collecting and preparation, returned to Canberra after a year's absence. He had been on Macquarie Island, close to the Antarctic Convergence, carrying out faunistic studies on its bird and seal populations for Australia's Antarctic Division. He brought back with him the most comprehensive collection ever made of the island's breeding bird fauna: 135 study-skin specimens plus diverse skulls and spirit-preserved material of 26 species (penguins, albatrosses, petrels, cormorants, skuas, gulls, and terns), including a unique year-round sampling of the plumages of the Antarctic Tern (*Sterna vittata*). These were not the first specimens to be collected for the Section. A CSIRO unit was originally formed under Francis Ratcliffe in 1949 to investigate the biology of the introduced rabbit and methods for its control. A secondary objective for the unit, to survey the biology of other native and introduced animals of economic or national importance, soon came to the fore on the heels of successful outbreaks of the myxoma virus from late 1950 on. With it came the need to build reference collections that provided documentation to support ecological data.

Keith, an easy-going Queenslander with a good share of street-smarts, was the Section's first collector-preparator. Specimens of birds and mammals soon began to flow in from around southeastern New South Wales upon his appointment in March 1954. The first bird was a Grey Falcon (*Falco hypoleucos*) from the Riverina, well outside its normal range in arid central and northern Australia; it is still the only specimen of this rare species in the ANWC. Housing incoming specimens created a curatorial problem. In 1953, the Section had moved into the Gungahlin Homestead, a fine old two-storey stone building on 20 hectares of grounds then on the north-western outskirts of Canberra. The homestead, listed in the Register of the National Estate and one of the three original great homesteads within Canberra's urban limits (including the Governor-General's residence, Yarralumla) remained its headquarters through to the early 21st century. In that time, the Section's name changed along with its research focus, first to CSIRO Division of Wildlife Research in 1962, then CSIRO Division of Wildlife and Rangelands Research in 1982, CSIRO Wildlife and Ecology in 1988, and finally CSIRO Sustainable Ecosystems in 2001 as the unit strove to reposition itself in CSIRO and science's marketplace.

Accommodation was limited initially to the homestead itself, requiring some staff to work off campus in offices in nearby suburbs and providing little space for collections. When Keith's Macquarie Island material arrived, it was "too much," and Robert Carrick, Keith's supervising scientist, made arrangements to trade it with the Museum of Victoria for access to Victorian material of the Australian Magpie (*Gymnorhina tibicen*). At the time, Carrick's decision seemed to make sense. On one side, the Section had no effective curatorial facilities; and the thrust of its research was ecologically-oriented and had, in Carrick's eyes at least, little use for preserved collections. On the other, the Museum of Victoria (then National Museum of Victoria) held century-old bird collections of national significance, and was an established repository for systematic and biological data. This raises the broader question: should the Australian National Wildlife Collection have happened at all? To understand why it did, some explanatory background is needed.

By the 1960s, the word was abroad in Australian ornithology that the days of collection-building were past. The surge in growth of the bird collections in Australian State museums from the late 19th century into the first decades of the 20th (catalyzed by E. P. Ramsay and A. J. North in New South Wales, W. B. Spencer, G. A. Keartland, and A. J. Cambell in Victoria, A. M. Morgan and S. A. White in South Australia, Kendall Broadbent and the Barnard brothers in Queensland, J. T. Tunney, A. W. Milligan, and F. L. Whitlock in Western Australia, and above all G. M. Mathews and H. L. White with their great private collections) had waned. Allen Keast had just finished his foundation work on speciation in Australian birds and the map of taxonomic and zoogeographic information provided by collections was now thought largely charted. Such perceptions were fostered then and later by zoologists unfamiliar with Australian ornithological history and systematics, and fuelled by the notion that collection = killing = anti-conservation. It was all part of a shift in zoological culture in the mid 20th century from natural history and systematics to ecological, reproductive, and behavioural research. That the latter were good for fauna management and a step forward for ornithology engendered the corollary that the older ways were outmoded, irrelevant, and destructive.

How poorly founded those latter perceptions were has since been exposed by Julian R. Ford's speciation studies on Australian birds (1987 and references therein), Sibley and Ahlquist's discovery of the Australian radiation in songbirds (1985, 1990), Barker et al.'s (2001, 2004) evidence that these songbird stocks are Gondwanan and ancestral to the songbirds of the rest of the world, and my and Ian Mason's conservation-oriented *Directory of Australian Birds* (Schodde and Mason 1999) with its inventory of the biodiversity units of Australia's passerine birds. All of these break-throughs had come, ultimately, from ongoing collection of specimens. At the root of the misperceptions was ignorance of the parlous state of Australian collections as records of Australia's bird fauna and as data sources for identifying bird taxa and tracing their historic distribution, evolution, and adaptations. All important early collections of Australian birds had either been dispersed and lost, such as those from the first and third James Cook expeditions and from the First Fleet colony at Port Jackson between 1788 and 1800 (e.g., Whitehead 1969; Sharpe 1906); or they had been deposited overseas, mostly in the Muséum Nationale d'Histoire Naturelle in Paris (Stresemann 1952) and the British Museum (now Natural History Museum) in London (Sharpe 1906). Such was the fate of material from the Baudin and Flinders expeditions at the turn of the 19th century (e.g., Vigors and Horsfield 1927, Sharpe 1906, Stresemann 1951), not to mention the great John Gould Collection of Australian birds that was eventually sold to the Academy of Natural Sciences in Philadelphia in 1849 (Meyer de Schauensee 1957).

The only really large Australia-wide collection by the mid 20th century was the private Gregory M. Mathews Collection of some 45,000 specimens now housed in the American Museum of Natural History, New York (Stresemann 1975:258, 268). Mathews, who had built it as the material reference for his enormous 12-volume *The Birds of Australia* (1910-1927) and other checklisting projects, had run into financial difficulties after the Stock Market crash of 1929 and offered it for sale to the Australian Government. Turned down, he then found a taker in Lord Walter Rothschild at Tring, England, who in turn sold it off with his own vast collection of some 280,000 bird specimens to the American Museum in New York in 1932. Rothschild, a bachelor and secretive in his personal life, needed the money to cover blackmail and scandal for his having a mistress and bastard child (Rothschild 1983). In Australia, almost all major collections were by then in the hands of the State museums which, constrained by funding and constitutional rules, had focussed their collecting programs on State bird faunas and still do. The one Australian collection that could claim continent-wide representation then was the H. L. White Collection in the Museum of Victoria; yet, despite its acclaim, it is rather small, of only *c.* 8500 study-skin specimens.

Gaps in collection representation were compounded by shortcomings in specimen documentation and curation. Although some collections, such as the H. L. White and those in the South Australian Museum, met basic standards with details of location, date of collection, and sex, most were deficient. The largest State collection, of over 45,000 study-skins in the Australian Museum in Sydney (Gill 2006), epitomised the problem. By the mid 20th century, some 20% of its study-skin collection comprised exotic taxa; and, often due to disposal of original labels, as much as another 20% of its Australian material lacked either sexing or localities more precise than "New South Wales" or both. Despite their often superb preparation, moreover, the specimens had been exposed to daylight and dust in storage, leaving them faded and dirty. As material for systematic and geographic research, many were of little use. This, it must be stressed, was not the fault of the conscientious and able post-1950 curators, John Disney and Walter Boles, who inherited the problem and have done much to rebuild and expand the collection since.

Even when specimen data from State and overseas collections were combined, as Allen Keast did in his synthetic revisions in the late 1950s (referenced in Keast 1961), they could provide little more than the barest outline of Australia's bird species and subspecies, and their distributional limits; they could pose questions about speciation but not answer many. Keast had made a ground-breaking beginning, but gaps and uncertainties soon began to appear, much more the fault of the tools than the workman. There were two main reasons. First, much of the State collections comprised material gathered both by intention and chance from favoured haunts, visited again and again, close in and around State cities. Second, collecting expeditions further afield to the sparsely-inhabited interior and northern regions of Australia were often joint, supported by several parties. Such were J. T. Tunney's expedition to the Kimberley and Arnhem Land in 1902-1903 funded by Lord Rothschild and the Western Australian Museum, and the collectors F. Lawson Whitlock in western and central Australia and J. P. Rogers and Willrae McLennan in northern Australia, who were contracted variously by G. M. Mathews, W. D. K. MacGillivray, and H. L. White—see summaries for these collectors and their sponsors in Whittell 1954. Much of the western, central, and northern Australian material spread around different museum collections before the mid 20th century often comprised the same species from the same local sites taken by the same collector at the same time. This hardly summed to a geographically representative, let alone comprehensive record of the Australian bird fauna.

In a continent the size of Australia, far more comprehensive collections were needed, as the taxonomists of the day knew. But who was there to say so? In the decade after Allen Keast left Australia in 1961, just two practising taxonomists were left in Australian State museums: the reclusive Herbert T. Condon in Adelaide, and Gerlof F. Mees in Perth; and only Mees, who returned to Leiden in the late 1960s, had advanced tertiary training in systematics. Systematic ornithology in Australia, the island continent with one of the most distinctive bird faunas in the world and the likely, but then unknown, source of radiation of the world's song-birds, was in crisis.

Four who did appreciate the problem and were in a position to do something about it were Warren B. Hitchcock, John H. Calaby, Dominic L. (Dom) Serventy, and Harry J. Frith (Figures 1, 6) at CSIRO's Wildlife Survey Section. Hitchcock, originally ornithologist at the Museum of Victoria from the late 1940s to early 1950s and then foundation curator of the new zoological collections of the Animal Industry Branch, Northern Territory, in the mid 1950s, had transferred to the Section in 1957 as Secretary of its Bird Banding Scheme. He had been burnt and partly disabled in a road accident, and had come to find field work difficult (Figure 2). Calaby, a trained chemist who joined the

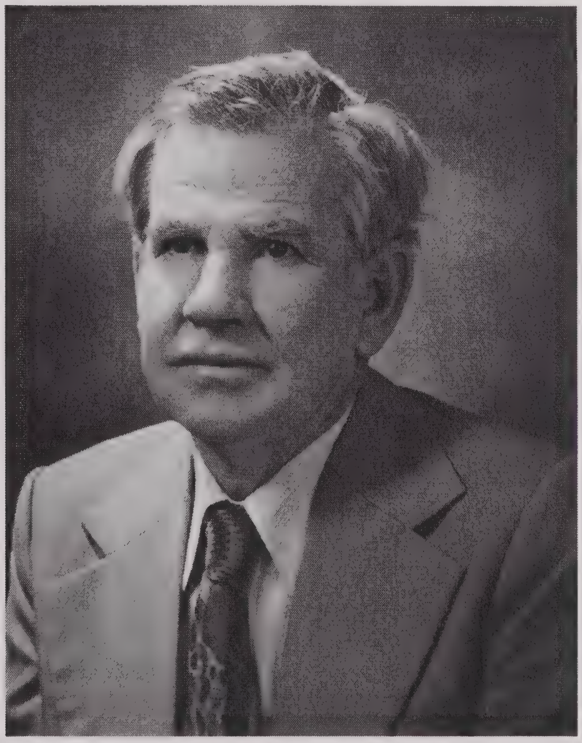

Figure 1. Harold J. (Harry) Frith, Chief of CSIRO Division of Wildlife Research, 1961-1981

Section earlier as part of its myxomatosis team, had become a natural historian of national eminence and specialist in mammalian systematics and biology. Serventy was already an Australian bird geographer and systematist of international note, having teamed with Ernst Mayr in a revision of the Australian thornbills (*Acanthiza*) as early as 1938 (Mayr and Serventy 1938). Based in distant Perth and working primarily on the Short-tailed Shearwater (*Puffinus tenuirostris*) on offshore islands, he was not, however, in the same position as the others to influence future events in Canberra. Frith, as tough-minded and patriotically Australian as he was dourly laconic, came from an agricultural background. Taking a research ecologist's position with the Section in 1952 to monitor myxomatosis, he carried out ground-breaking research on the ecology of the Mallee Fowl (*Leipoa ocellata*), then expanded his horizons into the ecology of waterfowl in the later 1950s, and by 1961 had become head of the Section. Next year, he raised the Section to a Division, CSIRO Division of Wildlife Research; and as its Chief, he

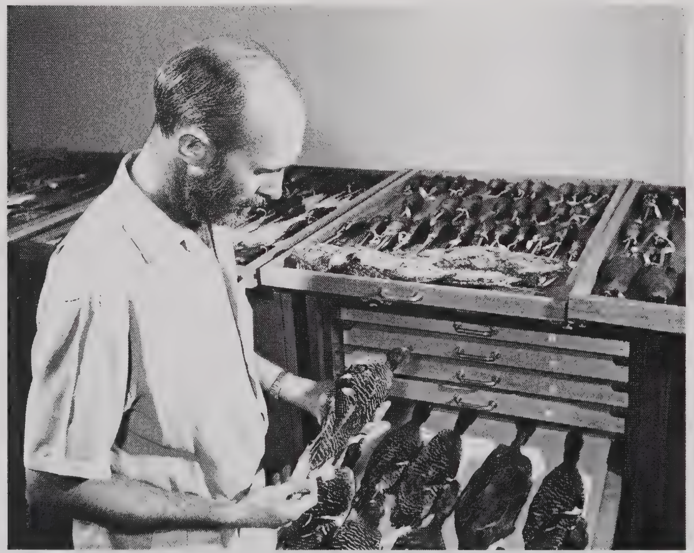

Figure 2. Warren B. Hitchcock, Curator of Birds, Australian National Wildlife Collection, 1966-1970, examining the ANWC's collections of the New Guinean Salvadori's Teal, *Salvadorina waigiuensis*.

became a dominating figure in Australian ornithology and wildlife research through the 1960s and 1970s.

As the 1950s closed, Frith, Calaby, and Hitchcock took the first steps towards their still-hazy vision of a national wildlife collection, consolidating what the Division held and improving the collecting of voucher specimens from ecological studies. Early products from ecological research were Robert Carrick's collections of Straw-necked Ibis (*Threskiornis spinicollis*) in 1955 and some 100 colour-marked hybrid black- and white-backed Australian Magpies from around Canberra, followed by Michael G. Ridpath's 40 specimens of Purple Swamphens (*Porphyrio porphyrio*) from Tasmania, and 200 specimens of Tasmanian Native-hens (*Gallinula mortierii*), covering all ages of both sexes and monthly plumage stages. Frith's work on waterfowl in the early 1960s had also yielded specimens, though rather patchily. Compensating for a dearth of some dendrocygnine, anserine, cairine, and tadornine taxa was a moderate sample of almost 30 specimens of Freckled Ducks (*Stictonetta naevosa*) and a great collection of nearly 100 Blue-billed Ducks (*Oxyura australis*), again covering all ages and monthly plumage changes. Mammals complemented the birds, the most important material coming from decade-long macropodid studies in western New South Wales and Northern Territory through the 1960s collected by Geoff Sharman, Bill Poole, Alan Newsome, and others. From the material collected, it was discovered that what was thought to be a single pan-continental species of Grey Kangaroo (*Macropus giganteus*)— Australia's best known kangaroo—comprised in fact two partly sympatric species (Kirsch and Poole 1972).

Regional collections also began to accumulate. Secure in the knowledge that there would be no repeat of his Macquarie Island experience, Kent Keith joined two voyages to the Coral Sea with Serventy, Gerlof Mees, and New South Wales ornithologist Keith Hindwood in 1960 and 1961, bringing back a small but important collection of over 60 specimens of 14 species of seabirds, part of which was shared with other State museums. At the same time, he and Calaby generated the first major mammal collections from a survey of mammalian hosts of the cattle tick in the upper Richmond and Clarence catchments of north-eastern New South Wales. In 1962, new appointee John L. McKean initiated the future national bat collection; and Norman Robinson sowed the seeds of a sound library, collecting recordings of bird song from all round Australia and purchasing the Division's first sound spectrograph.

Then, in late 1960, Frith, Calaby, and Serventy hatched an inspired plan to survey the vertebrate fauna of lesser-known corners of northern Australia. Thorough collections were to be made, to determine accurately the fauna present and to voucher all records. The resulting material would take Australia a big step forward in completing the preserved record of its bird fauna and lay cornerstones for a national wildlife collection. To get their taxonomic and zoogeographic bearings, as well as to replicate vital overseas reference material for ready access in Australia, the trio chose to begin with Cobourg Peninsula, at the very "Top End" of the Northern Territory. It was the site of John Gilbert's historic collections in northern Australia 120 years before, from which John Gould described many of his new species of northern Australian birds through the 1840s. In 1961, the first of seven 3-4 week-long trips set out for the Peninsula. By the last, in 1971, 640 specimens of 126 species of birds had been collected, plus 270 mammals. Included were topotypes of 43 bird taxa, valid and otherwise, that had been described by Gould and others. Notable among them were the Green Pygmy-goose (*Nettapus pulchellus*), Chestnut-backed Buttonquail (*Turnix castanota*), Partridge Pigeon (*Geophaps smithii*), Rufous Owl (*Ninox rufa*), Forest Kingfisher (*Todiramphus macleayii*), Rainbow Pitta (*Pitta iris*), Green-backed Gerygone (*Gerygone chloronotus*), White-gaped Honeyeater (*Lichenostomus unicolor*), Grey Whistler (*Pachycephala simplex*), and Great Bowerbird (*Chlamydera nuchalis*). Two more surveys followed to the southern rim of the Gulf of Carpentaria in the mid 1960s: one to the Sir Edward Pellew Islands and McArthur River under Kent Keith, and the other to the Nicholson River under Hitchcock and John McKean, in a joint venture with the Animal Industry Branch of the Northern Territory. Completed in 1968, they produced another 500 specimens of birds and some 450 mammals.

Hazards beset fauna surveyors in these remote Australian frontierlands in the 1960s. Cobourg Peninsula was still accessed only by sea barge from Darwin, and to while away the hours on board, the young "gun" collectors would roister with rum. On one balmy night in a light swell, R. J. "Mick" Burt simply rolled quietly off the deck into the sea in a daze. Because of the condition of other crew, almost 15 minutes passed before the alarm was raised and the boat turned to retrace its path; and then another 25 minutes went by before, by sheer chance, Burt was found in the dark, still alive and by now very cold and sober. The survey to the Nicholson River in 1967 was bedevilled instead by land vehicle problems: staked tyres and poorly-serviced, over-heating engines. Water was short, and, on occasion, the party even had to urinate into radiators to keep vehicles operational.

In the meantime, an initiative from an unexpected direction had a crucial impact on the development of the young Canberra collection.

A windfall from New Guinea.—Papuasia, comprising New Guinea and the archipelagos of Bismarck and the Solomons, holds the other, greater half of the Australasian bird fauna. That fauna, dominated by diverse lineages of corvidan songbirds, parrots, dacelonine kingfishers, phabine and ptilinopine pigeons, cuculine cuckoos, megapodes, and ratites, is unlike any other in the world. So any Australian reference collection of birds—and the systematic, zoogeographic and general evolutionary research based on them—is not only incomplete but also inadequate without complementary reference collections from Papuasia. Such had been the case for pre-1960 collections in Australian museums, except to some extent for those in the Australian and Queensland Museums; and it was now about to change.

As a fresh graduate in systematic botany, I joined CSIRO Division of Land Research, Canberra, in May 1960 to assist in the collection and identification of the vascular flora of Papua New Guinea as part of a land resources inventory program. My initiation in the montane rainforests of the Enga Province that year was a revelation, opening my eyes to the phyletic similarities and adaptational differences between the birdlife of New Guinea's rainforest and Australia's dry country. Next year, 1961, I was given the opportunity to do something about it on a four-month expedition to the Southern Highlands Province, camping for three weeks in alpine grassland above the tree-line on Mt. Giluwe, the second highest peak in Papua New Guinea, and collecting for a month around Lake Kutubu in primal rainforest at an altitude of 760 meters (2500 feet).

It cast the die for my work in New Guinea for a decade. Arrangements were first made to collect birds for the CSIRO Wildlife Research collections; and then, through the Australian Administration and E. T. Gilliard, we arranged for help from Tai and Yaga Kanz, two of Gilliard's native preparators from his 1950 American Museum of Natural History expedition to New Guinea. When they were picked up at the airstrip at Mt. Hagen, they had just been released from prison after serving several months for murder over a land dispute. Yaga, younger and much the better preparator, was one of the gentlest men I have ever met, unassuming and ever cheerful with a shy sense of fun. He was also naturally industrious and absolutely reliable and, recalled again and again, he carried the brunt of bird specimen preparation on all CSIRO expeditions until his death from pneumonia in the mid 1980s.

That first expedition in 1961 brought back 500 study-skins, and so did another by the same team in the following year, 1962, from the patchy rainforests and dry eucalypt woodlands around Port Moresby. Included were two specimens of the now-extinct subspecies of the Jacky Winter (*Microeca fascinans zimmeri*), which has disappeared for unknown reasons. At the same time, Hitchcock and Kent Keith were contracted to sample waterbird-life in the Sepik Province by Australian National University research on arthropod-born viruses; and they brought back another several hundred specimens. Then in 1963, Hitchcock, assisted by Yaga and Tai, replaced me on a CSIRO Land Research expedition to the Kubor Range, where he put together a further 450 specimens of montane birds as well as diverse mammals. On top of that, Ralph Bulmer sent the ANWC another 130 spirit-preserved birds from the Kaironk Valley, south of the Schrader Range.

Bougainville in the Solomons was my own destination in 1964 where, assisted by plant collector Lyn Craven and the indefatigable Yaga, we collected over 550 specimens of nearly 80% of the island's bird species plus 62 bats of seven species in just under three months (Figure 3). Earthquakes rumbled beneath our feet at least once a week, shivering trees and foliage in air strangely stilled of wind and bird sound. Next came the Gulf of Papua survey with the same team in early 1966. Over four months, we worked the immense mangrove-covered delta of the Purari River, the jungles of the Vailala River, the northwestern fringe of the east Papuan eucalypt woodlands on the Lakekamu River, the hill forests at the Devil's Gate on the Tauri River, and the montane forests of the Kukukuku mountains. Over 1700 birds were collected, representing almost half of New Guinea's bird species. I returned to Canberra at the end of four months, but Craven was not done. With remarkable grit, he continued to the central Sepik basin and Hunstein Range with Yaga and Tai for another three months, collecting 550 specimens of birds and many bats.

After a two-year hiatus, the New Guinean survey program re-started in 1969 on two fronts. On one, Harry Frith, ever the opportunist, sent his own collector, Tony Wolfe, to Port Moresby on funding for the con-

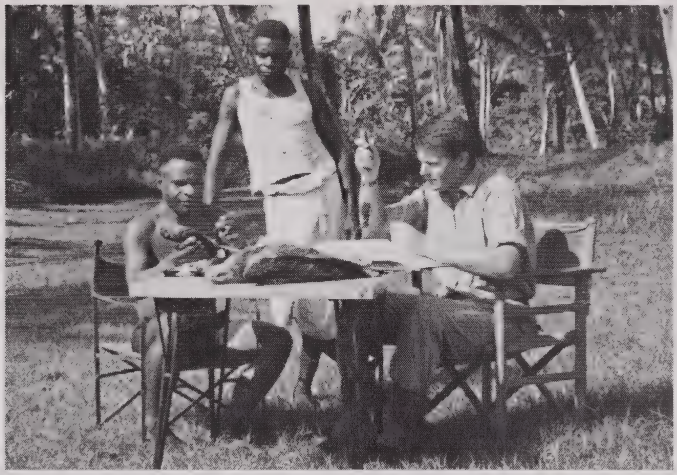

Figure 3. Richard Schodde in the field at Aku, Bougainville, Solomon Islands, 1964. With him at the table is Yaga Kanz, his preparator in New Guinea, while an assistant looks on. The large raptor on the table is Sanford's Sea-Eagle, *Haliaeetus sanfordi*.

trol of bird hazards on airfields. Wolfe's overt task was to do just that; but his covert task, on which he spent at least 90% of his time, was to collect pigeons for Frith's life-dream project to trace the life history of Australasian Columbidae and their seasonal cycles. Wolfe spent nearly a year in New Guinea. The results: some 500 specimens, mostly of 24 species of pigeons. On the other front, I returned to a survey of the south-eastern tail of Papua New Guinea with Warren Hitchcock and Yaga. It was a fruitful combination, with Hitchcock holding down camps in villages while I managed collecting in the bush, as high as 1900 meters (6000 feet) in subalpine grassland on Mt. Wadimana, a spur of the Simpson massif. Some 700 specimens were collected, including the Streaked Bowerbird (*Amblyornis subalaris*) in a new region, as well as small numbers of bats and other mammals. Next year, 1970, another foray was undertaken into sectors of the Astrolabe and southern Owen Stanley Ranges inland from Port Moresby, where modern topotypical material of the many New Guinean taxa described earlier from that region was collected to serve as points of taxonomic reference so far unavailable in Australia.

The New Guinean episode was coming to an end. At the end of 1970, I moved to CSIRO Wildlife Research to focus on the Australian bird fauna; and CSIRO's land resources surveys in New Guinea were all but complete as Papua New Guinea approached independence. A private expedition to Taam Island in the Banda Sea in 1971 was undertaken by students from the Australian National University, Canberra, and brought back a small collection of birds, most of which (40 specimens) passed to CSIRO Wildlife Research (Schodde and Mathews 1977). What was about to become the Australian National Wildlife Collection carried out only two more series of expeditions to Papua New Guinea in the 20th century. One in 1973, to the mountains around the Huon Gulf, was funded by Charles G. Sibley for his egg-white protein studies: Sibley took the egg whites, and the ANWC kept all specimens. With Ian Mason's skills as a collector and preparator, assisted once more by Yaga and Rambur, E. T. Gilliard's collector on his expeditions to the Sepik and Astrolabe Bay between 1953 and 1959, we put together 1300 specimens plus series of skeletons and egg clutches, in little more than six weeks.

The other expedition, primarily to collect a cross-section of New Guinean taxa for molecular systematics, was in fact a twinned one to the Port Moresby lowlands and adjacent montane sectors of the Owen Stanley Range (Efogi, Tetebedi, and Kokoda) in 1985 and 1987. Les Christidis, then a CSIRO post-doctoral fellow with the ANWC, was my co-collector on both trips, along with Lester Seri and Gaikovina Kula of Papua New Guinea's Department of Environment and Conservation. Another 950 specimens were taken, 720 of them on the 1987 expedition which, because of Christidis's imminent move to the Museum of Victoria, were split with that institution where the ANWC share of molecular tissues is still held.

My times in Papua New Guinea were crammed with experiences that explorers of natural history dream of. Two stand out. One was my failed attempt to establish a camp on Lake Loloru at 1450 meters (4500 feet) on Bougainville's southern volcanic range in 1964. It was a forbidding place, the lake a deep trench of black water surrounded by dripping tangles of *Pandanus*, on a mountain wreathed in mist and venting sulphurous fumes. We tried to move in by helicopter, but it was the season of the south-east trades which blew endless cloud in day after day. Just one load, of me, a native assistant and some mist nets, made it in on one grey morning at dawn before clouds came down. En route, the "chopper" was threatened by a pair of territorial Sanford's Sea-Eagles (*Haliaeetus sanfordi*), which stooped at us several times like *nasgul*, only to veer off just before doing themselves—and us—damage. We felt marooned and lost. In the circumstances, we made what we could of the opportunity, set nets and collected around the lake until mid afternoon, and then, guessing the right track down, forced a fast four-hour walk back to base camp at the foot of the mountain. It set the plan for the next three days: we trekked up the mountain before first light and back in the late afternoon to finish plant, bird, and bat sampling of Bougainville's stunted cloud forests as well as we could.

Yet nothing was as eventful or inspiring as my time on Mount Giluwe in August 1961, then at the last frontier of the stone-age in Papua New Guinea. The tone was set on our initial ascent to its alpine grasslands. Equipment and supplies for both bird and plant collecting and an indigenous field staff of 10 for 3-4 weeks required a long porter line of about 150 persons. Usually porters in montane New Guinea arrive at dawn or the evening before, so that an early start can be made to avoid the almost inevitable afternoon rains. On the morning of our move, however, none had arrived at our base camp at the south-western foot of the mountain in the Anga River valley. Just before noon, they started to trickle in, and I soon found out why. Clan brawling was rife in the area, and there had been a small massacre in one of the villages. Evidence—dismembered hands, arms and feet—had first to be brought into an administration camp on the Anga before the porters came on to me. By early afternoon, however, all porters had arrived and, because the weather had held off, I decided to make a dash for the alpine grasslands at 3200 meters (10,000 feet) which I estimated we would reach in four or five hours of slog up a steady, even gradient.

Two hours into the trek and minutes after our first King of Saxony Bird-of-Paradise (*Pteridophora alberti*) had been collected, the heavens opened. Torrential rain forced the entire line of porters, strung back for a mile (1.6 km) and more through the forest, to take cover; and it drenched, split and spoiled most of our bags of rice. There was no option but to set camp and spend the next day regrouping. That night, over half the line spent the night sleeping with their loads back along the trail. In the morning, space was cleared for a temporary camp, and some of the early-arrived porters, ever hatchet-happy, continued to cut down trees. Inevitably, it happened. One of the trees crashed the wrong way and came down in the middle of the camp, breaking a tent fly and the stores under it and knocking out a porter. Fortunately, the man was of the same clan as the cutters—otherwise, in their present mood, the porters would have quickly had their hatchets out severing flesh and bone, not wood. I checked the hurt man over, and finding no obvious wounds or breaks, laid him out on a stretcher under blanket where he lay shivering, comatose.

He stayed that way for the rest of the day and the following night; and as the porters came in, they gathered around him, wailing loudly. They thought he was going to die. They wailed all afternoon, and they wailed long through the night, 150 of them, in a fearful dolorous moaning deep in the forests on a remote New Guinean mountain. It was frightening. That night I lay awake with my terrified bird-collecting party and botanical assistants from Madang, altogether in one tent, guns at hand just in case. Next morning the man's condition was unchanged. So I organised the porter line for the final push up the mountain except for six men which were detailed to carry the victim back to an aid station. I later heard that the moment we were out of sight, the patient sprang from his stretcher, grabbed the blanket and fled to his village—he had never owned anything as valuable as a blanket before.

The three-week alpine camp on Mt. Giluwe above the treeline at 3365 meters (10,500 feet) proved an invigorating mix of stress and enchantment. The south-east trade winds, biting at that altitude, blew gustily on most days, bringing in bank upon bank of rain clouds and flurries of snow at higher levels. Some days were so bad that we only had the first several hours of daylight for collecting; the wind howled through our tents; and under foot in camp, the ground became so boggy that we had to lay in floors of bark cut from the Alpine Cypress (*Papuacedrus* sp.). As everything became damp and soggy, tempers grew short. Yet, when the wind dropped and the sun shone, the alpine meadows were transformed into a sparkling fairyland, dotted with palm-like tree ferns, dwarf rhododendrons and banks of buttercups and gentians amid tundra-like fields of grass. Crystal tarns covered star-shaped tussocks of the ancient lycopod, *Isoeetes*, and on their surface rode groups of Salvadori's Teal (*Anas waigiuensis*). Old World Island Blackbirds (*Turdus poliocephalus*), giant Alpine Pipits (*Anthus gutturalis*), Brown Quail (*Coturnix ypsilophorus*), and Papuan Grassbirds (*Megalurus macrurus*) made a meeting of the continents with the purely Australian bird fauna in the moss- and fern-festooned elfin shrubberies at the treeline. There Ribbon-tailed Birds of Paradise (*Astrapia* *mayeri*), Crested Berrypeckers (*Paramythia montium*), White-winged Robins (*Peneothello sigillatus*), Regent Whistlers (*Pachycephala schlegelii*), and Grey-streaked (*Ptiloprora perstriata*) and Sooty honeyeaters (*Melidectes fuscus*) flipped and flirted about almost like sparrows. Like the stream of biologists to visit alpine New Guinea before me, I had succumbed to its unworldly spell.

By the year 2000, the ANWC held some 8800 Papuasian specimens—including skeletons and spirit specimens plus a small but representative collection of eggs—of almost 80% of the region's land and inshore water bird species. The collection is now among the larger global samplings of Papuasian birds after those in the American Museum of Natural History, and in study-skin specimens is about the size of the H. L. White collection of Australian birds in the Museum of Victoria. In preparation, the material is satisfactory to very good, and accompanying locality, altitudinal, and biological data, covering soft-part colours, weight, fat, and moult, are comprehensive.

The early growth (mid- to late 1960s).—The growing collections in CSIRO Wildlife Research forced their management. In a decisive move, Frith shifted Warren Hitchcock from his position as Secretary of the Australian Bird Banding Scheme to manage the bird collections in 1966, and at the same time gave John Calaby charge of the mammal collections. Both were given assistants as well, with Kent Keith the senior preparator. Weary of waiting for action from head office, Frith had also taken the initiative to build his own accommodation for his growing Division. He had, *inter alia*, a series of stand-alone concrete-block rooms built out from the eastern perimeter of the Gungahlin homestead to house the library and other facilities, including an animal house for keeping live animals under controlled conditions. The structures, erected mostly between 1965 and 1976, were not pretty, but they were effective. Added at the back of the library—the present global climate change facility—was a large vault. It was the first collective home for the diverse specimen collections, which until then had been ferreted away in cabinets and cupboards in different offices on site; and it heralded a curatorial procedure kept to this day, that of holding the collections in fully enclosed, window-less, air-conditioned rooms shut from daylight. In this case, the only air-conditioning came from a noisy humidity controller which, given Canberra's naturally dry climate, was not particularly useful.

Drawered cabinets began to be installed in numbers in the new vault, while Hitchcock, Keith, and Calaby developed diverse data sheet and labelling systems for the incoming specimens. Because of the Division's background in wildlife biology, the curatorial staff prided itself not just on standards of preparation, but also on the precision of geographical and biological information attached to each specimen. For birds, this covered habitat and the colours of external soft parts and bare skin, as well as weight, moult, skull ossification, and fat deposition. The ANWC collections are especially valuable for their consistency in such data.

Yet despite these developments, the collections kept expanding beyond available space. Frith's Division, benefitting from a sympathetic relationship between Frith and Sir Frederick White, then CEO of CSIRO and supportive of research into Australia's wildlife resources, underwent unprecedented growth in the later 1960s. Outlying laboratories were established in Perth and Darwin. Gerard (Gerry) F. van Tets, joining in 1966 for research on bird hazards at airports, began collecting bird skeletons to help in identification of debris from bird strikes. It was the embryonic beginning of the ANWC's bird skeleton collections. A heated "bug" house was built, well away from other installations to house a dermestid colony for cleaning feather and flesh from bone. Maceration, also used to clean bones, proved a mixed blessing, helping van Tets in his personal taphonomic research but disarticulating skeletons to reduce their usefulness for functional and comparative studies. Wim Vestjens, a highly talented naturalist with remarkably diverse capabilities, joined van Tets and by 1970 had begun a survey of the bird fauna of Lake Cowal in the northeastern Riverina, New South Wales, eventually collecting 284 specimens, mostly of waterbirds. Hans Dimpel, a trained taxidermist, walked in off the street, asked for a job, and got one as a tanner for the Division's growing collections of kangaroo study-skins. Frith's largesse soon had him assisting field surveys on the Sir Edward Pellew Islands and Nicholson River in the Northern Territory as collector-preparator, and allowed him to start his own survey of Kosciuszko National Park birds and mammals in 1968. The last project produced a remarkably comprehensive collection of around 600 bird specimens. In 1966, Joseph M. Forshaw, budding psittacid authority and technician in the Division's rabbit-control program, was joined by John McKean and A. O. (Tony) Wolfe on a parrot exploring expedition to Iron Range on Cape York Peninsula, and returned with comprehensive series of Eclectus (*Eclectus roratus*) and Red-cheeked (*Geoffroyus geoffroyi*) parrots and the Cape York Double-eyed Fig Parrot (*Cyclopsitta diophthalma marshalli*).

It was a time of heady opportunism for wildlife science, and new staff kept pace with new projects. Ably assisted by Graeme Chapman, Ian Rowley was assigned in 1963 to begin his classic study of crows and ravens and their impact on the rural industry. He found two unrecognized cryptic species and one undescribed subspecies endemic to the New England tableland, New South Wales (Rowley 1967, 1970). Completed in 1967, the study produced some 310 specimens covering all five species of Australian corvids continent-wide, including the type of the New England Forest Raven (*Corvus tasmanicus boreus*). Frith began two new projects that added considerably to the collections, one an investigation of the seasonal ecology of quail (*Coturnix*) and buttonquail (*Turnicidae*) in 1967, and the other his cherished biology of the Australian pigeons in 1965. The quail project had finished by 1972, producing some 220 specimens of *Coturnix* and 120 specimens of diverse turnicids, mostly Little (*Turnix velox*) and Red-chested (*T. pyrrhothorax*) Buttonquail. The pigeon project carried on until Frith's last years at the Division. To help his recording of behaviour and life history, he built a large flight aviary onto his office. There, sitting at his desk, he could watch and film pigeon behaviour through a floor-to-ceiling window that, looking into the aviary, stretched from one side of the room to the other. Frith's pigeon collections were enormous, totalling almost 2900 Australian and 500 New Guinean specimens, and are still much the largest for single species in the ANWC. They include over 770 of the Spinifex Pigeon (*Geophaps plumifera*) from right across the range of that species, from the Pilbara and Kimberley to central Australia and inland northeast Queensland. They also include 490 Spotted Turtle-Doves (*Streptopelia chinensis*) from urban sites between Perth and Cairns. Both series of specimens were the subsequent subjects of major taxonomic papers (Frith and McKean 1975, Crome et al. 1980). The Australian pigeon collection was particularly comprehensive, covering all species from all parts of their ranges, and collected by a who's who of Divisional technical staff: Bevan K. Brown, R. J. "Mick" Burt, Mark Clayton, Peter Hanisch, Kent Keith, Bill Martin, Ian J. Mason, J. L. McKean, Les Moore, Phil Moore, Tony Wolfe, John C. Wombey, and the young experimental officer, Francis Crome. A Chief of Division could call on all the staff he needed whenever he needed it—almost.

One further collection of significance swelled the ANWC in those years. In 1967-1968, I returned to the University of Adelaide for post-graduate research in systematic botany, and spent much of my spare time sampling populations of the supposedly hybrid Adelaide Rosella (*Platycercus elegans* "*adelaidae*") from throughout its range, from Fleurieu Peninsula to the Flinders Range in South Australia. Since joining the South Australian Ornithological Association as teenage student, I had been fascinated by the variation in the colours of the local rosellas, observing what seemed to me yellower birds in river gum woodland in Belair National Park and redder birds in higher-altitude sclerophyll forests. Did the shift from redder birds in the south of the Mt. Lofty Range to yellower birds in the north reflect a climatically-induced cline, or was the patchy variation due to historic introgression between former stocks of Crimson Rosellas (*Platycercus elegans*) in sclerophyll forests and Yellow Rosellas (*P. flaveolus*) in more open woodlands? Now I had a chance to test these alternative hypotheses. Six main sampling sites were chosen, spaced out along the length of the Mt. Lofty Range, each with paired habitats of sclerophyll forest and open woodland, and sampled in summer and winter for a minimum 10 adult males per habitat per site per season because males, the homogametic sex, were more variable than females. A number of young bird watchers from the South Australian Ornithological Association helped me, but none was as energetic and humorously supportive as veteran bird bander Max Waterman. Max and I and other members of the group spent many a carefree Sunday in his small banding office at the back of his former home at Magill, skinning birds while another colleague, Robin Briggs, filled and wrapped the specimens. Altogether, some 300 rosellas were collected.

Such were the pressures on the ANWC for storage and curation by the end of the 1960s. For Hitchcock it proved too much. In poor health because of the burns from his accident in the Northern Territory, and requiring regular skin grafts, he retired in early 1970. Dom Serventy had just retired too, leaving it to Frith and Calaby to consider options. It was time to place the fauna survey program and the Division's wildlife collections on a sound coordinated footing. Frith had a leader with gravitas in Calaby, and any number of talented young technicians to do the field work. What was needed was someone in the middle to pull operations together, add botanical expertise on habitats, and take over and develop the collections.

Figure 4. Richard (Dick) Schodde, Curator-in-Charge of the Australian National Wildlife Collections, 1970-2000.

When Frith and Calaby heard through my colleague Wayne Braithwaite, a protégé of Frith's, that I was interested in coming across from botany, I was head-hunted. Not only was I a known quantity to them as a collector/curator and systematist/biogeographer, but I also had the botanical experience needed for identifying and mapping habitats for fuana surveys. In late 1970, I took the position of Curator of Collections, covering all preserved wildlife collections at CSIRO Wildlife Research, with duties to develop and protect the collections under my responsibility, to assist in Divisional faunal surveys as required, and to conduct research of my own choosing (Figures 4, 6). Calaby, now Assistant Chief, was designated leader of a newly established Divisional program of surveys, in which the ANWC was placed. Its staff comprised John Calaby and me as research scientists, with Peter Martensz as assistant botanist, Heather Abercrombie as curatorial assistant, Kent Keith and Hans Dimpel as Canberra-based preparators, and Tony Wolfe and Ian Mason as field fauna-surveyors and collectors in Darwin. Gerry van Tets was to join several years later.

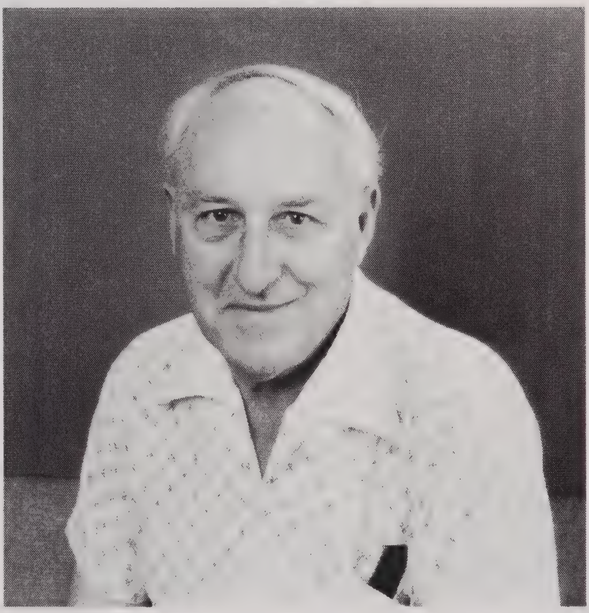

Figure 5. John H. Calaby, Curator of Mammals, 1966-1970, and Leader, Wildlife Survey Program, 1970–1987.

Because it is referred to time and again in this history, the research structure in CSIRO through the last half of the 20th century needs explanation. Major fields of research, such as wildlife biology, atmospheric physics, and plant industry, were run by *Divisions* headed by a Chief who was answerable to a central CSIRO executive. Within Divisions, major areas of research, such as pest control, fauna survey, and ecosystem function, were run by on-going *research programs* headed by a program leader answerable to the Chief and his Divisional executive; and Divisional programs comprised *research projects*, with a project leader and supporting staff, which ranged from small and short-term to large and long-term. The ANWC was a large, long-term project and I was its leader, under Calaby as leader of the survey program (Figure 5).

The founding of the ANWC (1970 - 1980).—When I took charge of the Divisional collections in late 1970, their bird material comprised about 11,000 specimens, over half of which had come from New

Guinea. My attention turned first to curatorial procedures to cope with growing collections of birds, mammals, and herpetofauna. Records had been kept in little more than exercise books, and data sheets for birds and mammals were inconsistent in format; there were none for herpetofauna. To simplify data entry in the days before computers, I introduced stout, expanding, loose-leaf Kalamazoo file binders as registers, designed new small folding labels on which determinavits could be written inside, and rationalized the data sheet system with common fields for data common to all vertebrate classes. The objective of data sheet formatting was twofold. First, it served as a prompt for all the information that needed to be collected from each class of animals. Second, it cut out the first step in a previously laborious and error-adding process from data-entry into notebooks in the field, to transfer to data sheets, and to subsequent registration and formal labelling at Canberra by the curatorial assistant. With a sense of hopefulness, I also introduced appropriately coloured labels for type specimens. Today the ANWC holds 43 holotypes, 13 neotypes, and 23 paratypes of Australasian birds, the earliest being the holotype of *Malurus alboscapulatus kutubu* Schodde and Hitchcock, 1968, from Lake Kutubu in Papua New Guinea.

That is as far as data processing was taken until the advent of personal computers. Hitchcock had devised separate hand-written card indices for localities, dates and taxa, but maintaining them was time-consuming. In any case, I believed in Ernst Mayr's dictum that a well-ordered and -curated specimen collection is self-indexing. Little was needed to improve specimen preparation and data gathering, except perhaps for the recording of habitat and preparation of spirit specimens which were then not preserved initially with formalin. Procedures for making bird study-skins, introduced by Kent Keith, remain today, their strength coming from a central metal rod passed through the tail-base and fixed in the skull, and around which both wings and feet are tied. Broken-off heads, limbs and tails are virtually unknown in ANWC collections.

Coincident with my arrival, the Divisional library moved to a new building next door, and its old building, which already housed the existing collections in a vault in the back, was turned over entirely to the Collections and Calaby's survey program. I was then set the task of designing the integration of all collection facilities and offices in this and surrounding buildings. By mid 1971, all re-housing had been finished. The old library had been turned into two equal-sized vaults, one for birds, the other for mammals, leaving three offices for Calaby, Keith and me on one side and a large study room in the centre, between offices and vaults. The centre piece of the study room was an enormous table that was custom-made for laying out specimens for investigating geographic variation; it still remains as the main work bench in the central study room of the present ANWC building. The preparatorial and fumigation rooms, where prepared specimens were fumigated before incorporation into permanent storage, remained in an adjacent building, but next to them a new room was fitted out for the spirit collection of anatomical material. For the skeleton collections and Gerry van Tets, a comodious alleyway between this room and Frith's own office was then built. The collections at last had near-coherent storage in effective though not always attractive facilities, and with space for at least 10 years' expansion.

With facilities in place, attention turned to developing the collections and producing research from them. Operational responsibility was spread amoung appropriate staff: Calaby for mammals generally, McKean, Gregory Richards, and Bill Price for bats in particular, van Tets for skeletons, and Wombey and Bob McCarron for herpetofauna; I took on birds. Incoming material from Australian ecological projects that had flourished in the late 1960s now began to stop. Only Frith's sampling of pigeons across northern Australia continued, led by Frank Crome based in Mareeba, and Wolfe out of our own survey group in Darwin. That finished mostly by 1973. In southwestern Australia, a major initiative to investigate the ecology and impacts of cockatoos in the wheatbelt was underway by 1971, led by Denis Saunders, Graeme Smith, and Ian Rowley. Extensive collections of corellas and black cockatoos were put together by Saunders and Smith and their staff, many from areas critical for evaluation of geographic differentiation. Saunders went on to publish important revisionary work on the black cockatoos, confirming through the collections and behavioural information that the two long- and short- billed populations of white-tailed black cockatoos in south-western Australia were in fact distinct species. By the late 1970s, however, field collecting for those studies ceased as well.

It was the time for Calaby's new survey program to begin doing its job. On a trip to an ANZAAS (Australian and New Zealand Association for the Advancement of Science) meeting in Perth in early 1971, I was able to collect some 50 specimens in the nearby wheatbelt, to form a nucleus of south-western Australian birds. Dimpel's Kosciuszko survey was still collecting material, and I took time out with Peter Martensz to stratify and map its habitats provisionally and to establish sampling points in each. Dimpel followed the new survey prescription conscientiously for several years, but found himself increasingly unable to cope with pressures and collaborative work, and was eventually discharged in 1976 on medical grounds. With him went the core of the unpublished data for the Kosciuszko survey, and he still holds it today.

A new and much larger survey, however, was on the horizon: the Alligator Rivers survey along the western Arnhem Land escarpment in the Northern Territory, field work for which was to run from early 1971 to the end of 1974. The results of that survey were only published in mimeogaph form as part of the Commonwealth Government's Alligator Rivers Fact-Finding Study (1973), itself generated by conflicts between conservation and uranium mining interests. Those results nevertheless contributed significantly to the case for establishing Kakadu National Park later that decade, fulfilling a goal for which Frith had been working with senior officers of the Northern Territory administration. Frith and Calaby initiated the survey independently of the Government, sending a young Ian Mason to join Tony Wolfe in Darwin as field surveyors under direction from Calaby and me, with Calaby the main liaison in the field. Although responsibilities for the bird survey and habitat stratification lay with me, it was suggested that "the boys" in Darwin under Calaby's direction could handle these tasks while I stayed in Canberra to write up the Papuasian collections that had been gathered through the previous decade.

It was an early lesson: management of collections and wildlife surveys is as much about people as about specimens and field records (Figure 6). In its first year, the Alligator Rivers survey had gathered a wealth of mammalian data, mostly of endemic rodents, and moderate material of pigeons for Frith's pigeon studies, but only a tiny fraction of other birds and few bird counts related to habitat. Almost all of the material, furthermore, was from just one local area around Nourlangie Rock. It may have satisfied the mammal program, which had to deal with about 40 species apart from bats, but it was totally inadequate for the bird program which needed to account for 240 species along the whole Arnhem Land escarpment and adjacent plains. When I asked Wolfe, leader of the Darwin group, to improve the effort for birds and explore more widely, he resisted. It was a manifestation of a deeper problem. When I joined CSIRO Wildlife Research full of brash enthusiasm, I was keen to use my botanical background from CSIRO Land Research to develop wildlife survey methodology by stratifying animal habitats by vegetation type, sampling fauna in set habitats, and improving efficiencies in data recording and animal censussing. Yet to Calaby, Keith, and Wolfe, old Divisional hands who had done it all before in northern Australia, I was just a new boy, pushy and insensitive to their own intuitive seek-and-find approach. They were comfortable in their ways of fauna survey, which were indeed effective for small ground mammals; and I stood for change that they felt unnecessary. Moreover, Calaby and I worked at different paces.

To resolve a developing impasse, it was agreed that Wolfe report to Calaby for mammals alone, and Mason to me for the birds, and I then began to make regular field trips to Arnhem Land to keep my part of the project on track for birds and animal habitats. As project leader, Calaby also kept his own survey protocols for mammals, but it did not stop an uneasy relationship between us; and thereafter bird and mammal teams "played wide" of one another in the field. I damaged my relationship with Frith too who had envisioned this survey of his favoured part of Australia in the Calaby style, and resented my exploration of all habitats in the region, particularly the mangroves along the Alligator rivers themselves. For my part, I saw the mangroves and mud flats of the rivers as as much a part of our charter as the nearby sandstone escarpments—as did the Commonwealth Government Alligator Rivers Environmental Fact-Finding Study commissioned in 1972. Mason supported me as well, beginning a fruitful ten years of collaboration. In the summer of 1972-1973, we established wet season camps at El Sharana in the south and Cannon Hill on the East Alligator River in the north, as well using the mammal camp near Nourlangie Rock in the centre of the region. Then, by 4-wheel drive vehicle, boat, and on foot, we explored the length and breadth of the Alligator rivers region through all seasons of the year, from Tin Camp Creek in the north to Coronation Hill in the south, and from the South Alligator River in the west to the upper East Alligator River, Deaf Adder basin, and upper Jim Jim Creek in the east. We were able to find all the endemic Arnhem Land birds, record their habitats and status, and collect representative material of nearly all species of the regional bird fauna up to October 1974, when field work ceased.

Field work in the Alligator rivers region was a strange mix of the exhausting and magical. The heat and dust towards the break of the wet season were almost unbearable, with no cooling respite from swimming in tepid billabongs–crocodiles were then not a danger. Even worse was mangrove sampling in the wet season: sucking mud up over the knees, swarms of savage mosquitoes, and the monsoon beating down. Mason and I would work that habitat with a new can of spray-on insect repellent on each visit. The moment the can was emptied, usually within an hour, we would race for the boat, open water, and mosquito-free habitat. Yet the sight of water-lily covered billabongs along the Alligator rivers against the backdrop of craggy sandstone cliffs of the Arnhem Land escarpment never failed to inspire, especially after the drive across featureless plains from Darwin to the west. In pockets of rainforest in sandstone ravines, dominated by the endemic tree, *Allosyncarpia*, were Banded Fruit-Doves (*Ptilinopus cinctus*), Rainbow Pittas (*Pitta iris*), Sandstone Friarbirds (*Philemon buceroides ammitophila*), and White-lined Honeyeaters (*Meliphaga albilineata*), birds found almost nowhere else in Australia; and in the spinifex-clad rock faces above lurked the largest grasswren of all, the White-throated Grasswren (*Amytornis woodwardi*). Some of our dry season camps beside small shaded billabongs in the Deaf Adder basin, Jim Jim Falls, and Nourlangie Rock, now closed to the public, were close to paradise, particularly under a calm, star-filled tropical sky at night. We were privileged. Yet the 200-km drive to the Alligator rivers then from Darwin was unpleasant, on dusty, corrugated, unsealed roads which crossed the South Alligator River upstream by ford because the bridge of today had not yet been built.

Between 1971 and 1974, perhaps more time was put into the Alligator rivers survey than any other carried out by the Division. So it is ironic that, apart from the preliminary report for the Environmental Fact-Finding Study in 1973, nothing was ever formally published (see below) except for the habitats which had been such a bone of contention. With initial help from Martensz, I mapped our faunal habitats on to aerial photography for the entire region, a vast area that included almost the whole South Alligator River catchment and the lower East Alligator River and adjacent coastal plains. It was a solid seven-month task over 1975-1976, the results of which Mason then transferred to a line map. Unfortunately, however, the map was not properly justified to coordinates. After Kakadu National Park had been declared for the region, the then Australian National Parks and Wildlife Service (ANPWS) heard about the map and commissioned its correction together with an extension west to Kapalga and the Wildman River. This was duly carried out by Andrew Hedley and me in 1986-1987, and the map was printed and circulated under the name of the contractor, ANPWS. Even though the actual sources and authority for map interpretation were omitted, we still took much satisfaction from knowing that the map was published and out for park management and public use.

Enthused by the bird work in Arnhem Land, the energetic Mason arranged his own collecting program in his own time to East Timor, bringing back, with John McKean's help, a collection of several hundred birds, including an undescribed subspecies of the Pheasant Coucal (*Centropus phasianinus mui*). The Indonesian takeover stopped further

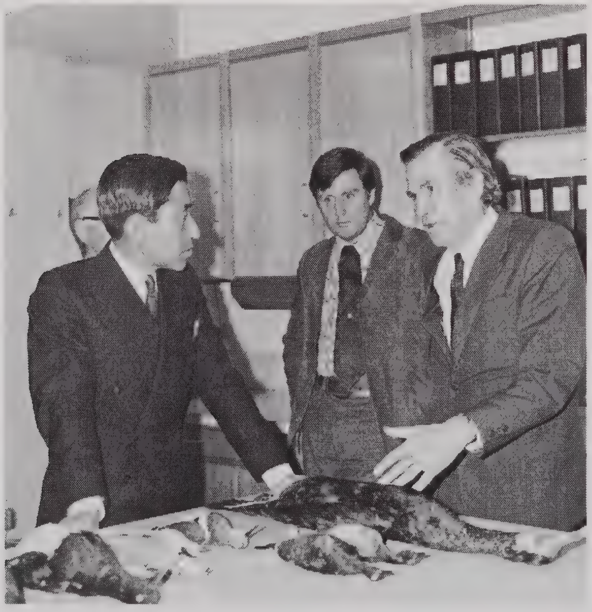

Figure 6. Crown Prince Akihito of Japan (left) during his 1972 visit to the future Australian National Wildlife Collection, examining specimens with Richard Schodde (center) and Harry Frith (right) in the ANWC.

work on Timor at the end of 1974, Cyclone Tracy hit Darwin in December of that year, and Mason and Wolfe were recalled to Canberra in early 1975. Early in the year before, however, the survey team had returned to the Nicholson River in the southern Gulf of Carpentaria at the invitation of the Northern Territory Animal Industry Branch to complete the survey that had collapsed so disastrously there in 1967. This time the objective of the expedition was reached: the China Wall, a low toothed ridge of sandstone just west of the Queensland border. Mason and I may have collected comprehensive material of the regional bird fauna, but it was Wolfe who excelled himself, returning from morning ablutions with a Carpentarian Grasswren (*Amytornis dorotheae*) or two in his pocket for three days in succession; Mason and I had seen grasswrens several times, but failed to collect a specimen. It was the first collection of the species since its discovery in 1914 and the first record on the edge of northwestern Queensland. Later that year, Walter Bock and Lester Short of the American Museum of Natural History took the opportunity of the 16th International Ornithological Congress in Canberra to spend some months with me in the field in southeastern Australia and Lake Eyre basin, gathering further material on rosella hybrids and skeletal material. Instruction from Bock on the preparation of spirit specimens and skeletons was particularly helpful for future practice in the ANWC.

During 1975, Mason and I had pressed ahead with habitat mapping and writing-up birds for the Arnhem Land survey together with John McKean who had joined us temporarily from Darwin. Kent Keith had retired, and a serial turn-over in curatorial assistants was stopped with the appointment of well-known Queensland ornithological identity Billie Gill and herpetofauna specialist John Wombey, another refugee from Darwin. In her 50s, Billie Gill was a conscientious curatorial assistant of enviable stamina, but her greatest asset was her capacity to "play mother," smooth over arguments, prick pettiness with good humour and maintain morale. She not only enjoyed field work but could also participate actively in it because of her sound field knowledge of birds. She was the most valuable helper that I had had for managing the collections.

The year 1975 also saw the beginning of a new survey commissioned by Mt. Isa Mines for the McArthur River region in the southwestern Gulf of Carpentaria. Calaby, Wolfe, and Dimpel were the mammal team, Mason, Ian Brooker (who stood in for me on the first trip), and I the bird team, and Wombey and Hal Cogger from the Australian Museum herptetofauna team. As well, I gained the services of my former New Guinean comrade-in-arms, Lyn Craven, as consultant habitat botanist from Canberra's Australian National Herbarium. Three trips were made, in the late dry season of 1975 and the mid wet and early dry seasons of 1976, for seasonal coverage. We employed the same procedures as in Arnhem Land, stratifying and mapping vegetation habitats from aerial photography, recording birds by habitat, and collecting vouchers of all bird species from the low but precipitous sandstone escarpments on the upper McArthur River to the mangroves and tussocky mudflats of its mouth and adjacent islands. Mason and I also added significantly to the material from the earlier Pellew Islands survey in the late 1960s, discovering an unknown subspecies of the Little Shrike-thrush (*Colluricincla megarhyncha*) and a new population of the Zitting Cisticola (*Cisticola juncidis*). En route from Canberra to the McArthur River in January 1976, we collected sporadically through Queensland; and on the journey home on the last trip, we spent several days sampling around Alice Springs, forming the nucleus of a collection of central Australian birds. Botanist Craven had told us he would find his own way to our main camp site on the upper McArthur River on his first and only trip in the wet season; he chose air. Driving through Mt. Isa in north-western Queensland on our way up ourselves, Mason and I chanced upon him standing on a street corner, fresh off the aircraft and gazing quizzically about. It was sheer coincidence. We stopped and asked him if he wanted a lift. He promptly accepted: "I was just beginning to wonder where the camp was and how I would get to it." Knowing it to be 500 miles from nowhere and without public transport, we did too.

The ANWC's representation of arid zone avifauna was augmented considerably in the next two years with the commissioning of yet another survey in spring 1977 and autumn 1978, this time as an environmental fact-finding study for a uranium prospecting consortium (Delhi-Wyoming-Vam joint venture). The region was the Lake Way area near Wiluna in the centre of Western Australia, the ANWC's first survey in arid mulga habitat. Because of the environment, we focussed on the bird and reptile faunas, the team comprising Mason and me for birds, Wombey and McKean for herptetofauna and the few mammals, mostly bats, and once more Lyn Craven to voucher plant dominants and assist me in habitat stratification, itself relatively simple. Over two seasons—

a dry spring in 1977 and normal autumn after summer rains in 1978—we recorded and collected material of a cross-section of arid zone birds, including the ANWC's first specimens of western Bourke's Parrots (*Neopsephotus bourkii*), Grey Honeyeaters (*Conopophila whitei*) and western Chestnut-breasted Quail-thrushes (*Cinclosoma castaneothorax*), together with a strange mix of black- and white-backed Australian Magpies. Of the Striated (*Amytornis striatus*) and Thick-billed grasswrens (*A. textilis*) recorded in the area by F. Lawson Whitlock in 1909 (Whitlock 1910), there was no sign. Forage in the region had been devastated by decades of over-grazing and drought, and these species had almost certainly become extinct in the region.

Back in Canberra, the growing importance of the ANWC as a material record of Australia's land vertebrate fauna had received a huge boost with its recognition and gazettal [official designation] as a National Biological Collection by the Australian Government in April 1976. The gazettal, that is, listing in the official Government Gazette, formalized the name of the ANWC, emphasized its status as a natural heritage collection, and vested its preservation and development in CSIRO. Its curatorial staff felt well-rewarded for nearly two decades of devoted work, but hardly appreciated the importance that the gazettal could have when moves to disperse or "moth-ball" the ANWC were attempted in late 1996.

By the close of the 1970s, Divisional funding had declined in real terms, bringing with it the demise of the fauna survey program. Henceforth all integrated survey work carried out by the ANWC would not be in faunistically needy regions but in areas where environmental impact assessments were required by industry, and on a fee-for-service basis. Frith had long lost his patron in Sir Frederick White, and his influence was waning; he was tired. He had been a strong Chief verging on the despotic, and had run the Division like a fiefdom isolated from the rest of CSIRO. He was suspicious of scientific staff (his "silvertails") and any motives, attitudes, and actions that might challenge his position as "the" leading figure in Australian ornithology of the day; as a result, he became openly antipathetic to a number of staff, including me. In staff disputes, he commonly sided with technicians (his "real workers"), to the advantage of control by "divide and conquer" yet often also to the disadvantage of good research. In my view, it diminished his stature as one of the most visionary, pragmatic, and influential leaders in wildlife conservation biology that Australia had in the 20th century. Born and bred in the country, he understood the problems and their solutions instinctively. If he had a blind spot, it was in seeking narrow solutions to broad issues, manifested in his focus on single problem species and, in faunal survey, on simplistic presence/absence approaches. The important synecological-community-landscape frame was missing. Further details of Frith's contribution to wildlife and avian research in Australia are given in Ian Rowley's chapter in this volume.

Much of Frith's antipathy I brought on myself, as the following incident shows. The Division's library holds one copy of "J. L. Peters'" 15-volume *Check-list of Birds of the World* (1931-1986), volume 3 of which includes both the pigeons (Columbiformes) and parrots (Psittaciformes). Whenever Frith sought that volume for work on his pigeons in the early 1970s, it was invariably out on loan to Joe Forshaw for his research on parrots. So Frith, as Chief, embargoed all loaning of the work. In the late 1970s when I was away on a field trip, he took a spot check and found just one volume missing, from among the passerines, and got Calaby to confirm it. No one on site knew of its whereabouts; the only culprit could have been me. Moreover, the loan card in the back of the missing volume had not been left in the library's loan card box as a record of the loan. Not only was I guilty of taking out an important reference work without authorisation, but I had kept it while out of Canberra and had covered my tracks by failing to leave a traceable record. When I returned, Calaby met me tight-lipped and sent me to report to the library about a "problem" that I had created. In the library I found that the missing volume of "Peters'" was the cause, and was told, in turn, that I now had to report to Frith. In fact, I knew nothing about the missing volume, but when I found out from the library that the missing volume was number 11, enlightenment dawned and alarm vanished. So I fronted up in Frith's office where he straightway launched into a tirade of accusation about selfishness and abuse of privilege. When I got an opening, I simply explained that I knew nothing about the missing volume and innocently asked what volume it was. "Number 11" spat the reply. "But Harry," I responded smugly, "that's the one volume in "Peters'" that hasn't been published yet." In fairness, Frith, an ecologist, could hardly have been expected to know the intricacies of passerine systematic literature; but he did not see it that way. The only apology I got was a terse dismissal: "get out."

By now, Frith had lost patience with the survey program, and with some reason. Although the program had fulfilled all external contractual obligations, only three surveys funded or supported from within CSIRO had been published in the decade, and all were from Papuasia: two from me on birds in 1977 (Taam Island, Bougainville) and one from John McKean on bats in 1972. For birds from the Australian surveys, there were two problems. One was the relative size of my tasks, which extended from describing and mapping vegetation habitats to writing up bird faunas which, because of the number of species, were three to four times the size of any other chapter. A typescript for the birds of the Alligator rivers was completed early in the 1980s—the only completed draft for any class of vertebrates—but the time for its publication had passed. The other problem was the standard of taxonomic and zoogeographic reporting for the surveys, based on the survey collections. As an ecologist, Frith was content to routinely refer all new populations surveyed back to old taxonomies, with little checking and background research, in order to get simple, basic details of species presence and absence out fast. As a systematist, I had a different view. Wherever we were in ornithologically little-known areas, I felt we had a responsibility to work out the taxonomic identities and affinities of local populations properly, in case they were distinct, endemic, and of conservation concern. This meant careful comparison against populations from neighbouring regions and clarifying major regional affinities wherever existing taxonomy was inadequate. That was the trouble: most taxonomies across the class Aves were then seriously inadequate. The eclectic studies of Allen Keast and Julian Ford had picked out many topical and juicy problems, but at the same time had left many gaps. For nearly all freshwater birds and Australia's largest family, the honeyeaters (Meliphagidae), the incompetent revisions of Gregory M. Mathews in the early 20th century still formed the taxonomic base. Mismatches and inconsistencies between those taxonomies and the material coming into the ANWC led me deeper and deeper into a range of taxonomic questions across all families of Australian land birds and to increasing visits to interstate collections for solution. To adopt the Frith approach instead would have meant not only shallow science, but, more importantly, glossing over information vital to inventorying and understanding bird biodiversity in Australia.

So I resisted it. It led to impasses over the production of the Bougainville survey which I had written up by 1973. Time and again Frith, who had control over its editing as an in-house technical paper, sent it back with instructions to cut it down, mostly the taxonomic sections. The first draft was taxonomically excessive, and perhaps the second, but not the third or fourth. Identified for cutting were new approaches to breaking complexes of subspecies into allospecies, in such extensively polytypic species as the Golden Whistler (*Pachycephala pectoralis*) and Collared Kingfisher (*Todiramphus chlotis*), approaches coming into use in birds only now. Another four years was to pass before the Bougainville paper was finally published in 1977, its taxonomic commentary all but emasculated. How much more difficult would the preparation of the Alligator Rivers survey report be, for an area close to Frith's heart and about which he would have still firmer ideas. There seemed to be little future for the production of survey reports while he was Chief.

Despite this, a steady stream of taxonomic and zoogeographic papers on birds was beginning to come out of the ANWC, first on New Guinea birds by John McKean and me, and later on Australian birds with Ian Mason. Nearly all of the papers resolved questions of identity and affinity arising directly or indirectly from the ANWC's surveys, including the discovery of undescribed subspecies of the Helmeted Friarbird (*Philemon buceroides ammitophila*) and Little Shrike-thrush (*Colluricincla megarhyncha aelptes*)(Schodde et al. 1979, Schodde and Mason 1976a, respectively). Much the most important, however, was my paper with John Calaby which reinterpreted the bird and mammal faunal relationships between the Australian and New Guinean rainforests in terms of vicariance and antiquity (Schodde and Calaby 1972).

Finding directions (1980-1994).—Frith's disenchantment with the ANWC survey program and my taxonomic research, together with lack of prospective field work, had a depressive effect on staff by the turn of the 1980s. When Lester Short of the American Museum came to Australia in 1979 to work with the ANWC on hybrid zones in Australian birds, I had to take leave to join him. Then, after finishing the book *Nocturnal Birds of Australia* with me (Schodde and Mason 1980), which included recognition of the Lesser Sooty Owl (*Tyto multipunctata*) as a species, Mason left in 1981 for greener pastures in northeastern Queensland. Frith had offered him a place in a rainforest fauna survey program set up under Francis Crome at the CSIRO facility in Atherton. With his departure, the ANWC was left without a trained bird preparator.

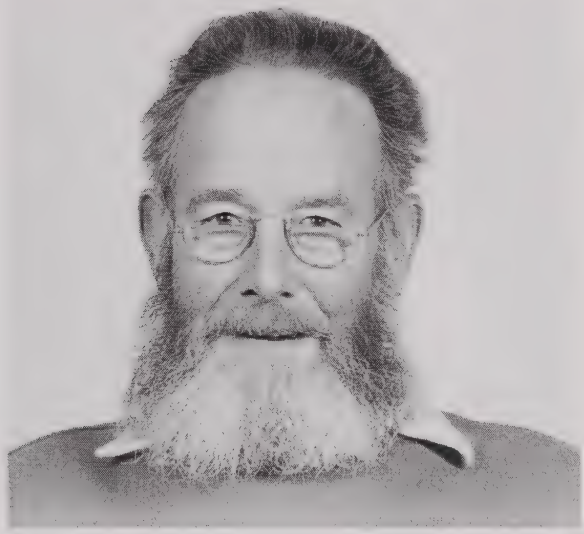

Figure 7. Gerard F. (Gerry) van Tets, Skeleton Collection Manager, 1970 - 1987.

It came at a difficult time. ANWC collections from Western Australia up to the late 1970s had been confined to several species of cockatoos and a small patchy representation from the south-west. Then Peter Gowland, formerly of CSIRO Land Research, was appointed bird control officer on the plantations of the Ord River in the Kimberley of north-western Australia, and he arranged to send the ANWC a wide range of potential-pest voucher specimens from all habitats in the region. The specimens were air-freighted frozen in batches to Canberra, and there prepared in the ANWC preparatorial rooms. Frith's pigeons apart, they formed the ANWC's first extensive collections from that region, and included good samples of such species as the Magpie-Goose (*Anseranas semipalmata*), Brolga (*Grus rubicundus*), Galah (*Eolophus roseicapillus*), and several species of mangrove songbirds from Derby. At the end of his project in 1981, Gowland sent down his last batch which included material of a number of critical sandstone species that I had specially requested, including specimens of hybrid Variegated Fairy-wrens (*Malurus lamberti assimilis* x *M. l. rogersi*). But by then

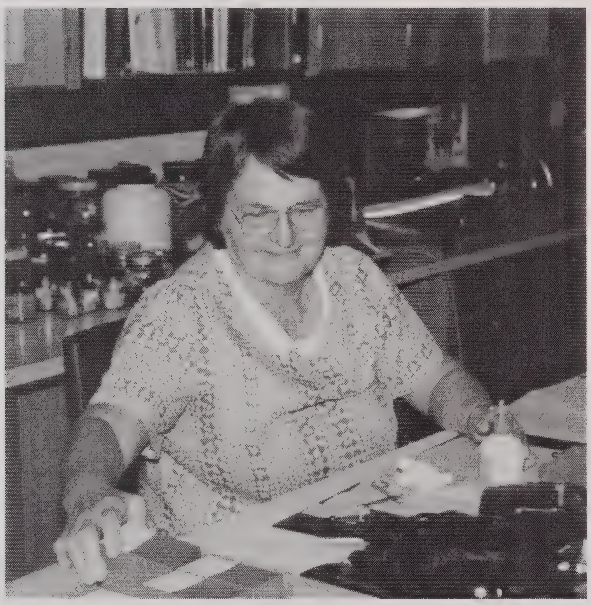

Figure 8. H. Billie Gill, Curatorial Assistant, 1975-1988, at work in the ANWC collections.

Mason had left, and, lacking a preparator, I had to send them on to the Australian Museum, Sydney, to be saved.

Following a heart attack after a review of his Division, Frith retired in 1981. In the inter-regnum until new Chief, Charles Krebs from the University of British Columbia, Canada, was appointed in 1982, it was a time to take stock. The survey staff now associated with the ANWC comprised Calaby as survey program leader, me as curator, Billie Gill as general curatorial assistant, John Wombey to attend to herpetofauna and public enquiries (contentedly self-appointed), Tony Wolfe as mammal preparator under Calaby, and Gerry van Tets for bird skeletons (Figure 7). Within a year or so, Wolfe too had moved on. There was no longer a formal field-collecting program; we were in a catch-up, report- and paper-writing mode. In the hiatus I arranged to acquire specimen material from outlying Australian territories, notably Christmas and Norfolk islands, through the Australian National Parks and Wildlife Service. Small but comprehensive collections of sea- and land-birds were accumulated over several years from these sources, including the

Christmas Boobook (*Ninox natalis*), Abbott's Booby (*Papasula abbotti*), the Norfolk Island Parakeet (*Cyanoramphus cookii*), and Pacific Robin (*Petroica multicolor*). They complemented a valuable collection of Lord Howe Island birds made by John McKean in the early 1970s. By 1982, I also discovered that Billie Gill could not only label birds efficiently, but also skin and fill them creditably (Figure 8). To keep the collection growing, I then began to spend each afternoon with her in the preparatorial room preparing bird study-skins and choosing skeletons and spirit specimens which were passed to van Tets and Wombey, respectively, to finish. It was a routine that I kept to my retirement in 2000. After Mason's return in 1988, I found it particularly useful for discussing ANWC development plans and mutual taxonomic projects and research. His input was invariably practical and inventive.

A new issue had arisen: the *Australian Checklist of Birds*, a project of the Royal Australasian Ornithologists Union (RAOU). In 1974, the Union's then checklist compiler, the late H.T. Condon, retired from the position after completing a checklist of non-passerines that included subspecies as well as species for the first time. I was appointed to replace him, and after producing an interim list of passerine species the next year to complement the non-passerine species of Condon's *Checklist* (1975), began the much more involved work of sorting out the subspecies of passerines and their nomenclature with Walter Boles, Glen Ingram, and others. We quickly ran into the same trouble that I was having with survey reports: unrevised, ill-circumscribed subspecies, with no certainty about which name in the literature applied to what. For both the *Checklist* and the ANWC it raised one question and two avenues for solution.

The question was: were subspecies worth bothering with? It has been put by Libby Robin (2001:324-326) in a review which found that their inventory as "ultrataxa" in the *Directory of Australian Birds* (Schodde and Mason 1999) "brought new and complex classifications" that more than doubled the taxa of Australian birds for conservation management while the same old inadequate funding resources remained. It begged the corollary: do subspecies matter? In the science of systematics and biogeography, subspecies are the terminal ranks of taxa that express the most recent evolutionary differentiation in faunas; for that reason alone they need to be known. Yet there is a still more fundamental reason for their recognition and use. The subspecies circumscribed in Australia by Allen Keast, Julian Ford, and me are, judged by their mix of expressed morphological traits, genetically distinct regional populations, not end points in primary clines. As such they are basic units of biodiversity, surrogates for the evolutionary significant unit of molecular geneticists (e.g., Moritz 1994a,b), and identifiable in a fraction of the time at a fraction of the cost. They are, as Bock (2000) points out, essential in understanding the diversity of birds.

Determining these units is the first basic step in inventorying the natural biological resources of any country, for conservation or any other purpose. Only after that is done can taxonomic rank, such as species or subspecies—and conservation priority—be attributed in a balanced way across avifaunas as a whole. It is a message that rings out loud and clear from Denis Saunders' (1979) studies of the Yellow- and White-tailed black cockatoos and those of my own and others on corellas (Schodde et al. 1979). Yet this huge task of inventory has been addressed only patchily in Australian ornithology, partly because of the inadequacy of museum collections and partly because of the few, and often part-time taxonomists. There is still no complete up-to-date inventory of Australian birds today based on across-the-board revisionary research. Short cuts had been taken in the quick production of species lists, beginning with the first and second RAOU *Checklists* in 1913 and 1926. As a result, there has been far more flux and argument over the limits of species and subspecies than there should have been in a bird fauna moderately well-known—but not known well-enough—since the time of Gould. So our then RAOU checklist team pressed ahead with check-listing down to the level of subspecies.

Of the two solutions, the first was the production of separate family by family taxonomic revisions because checklists, essentially nomenclatural documents, needed to be based on sound taxonomies. It was the germ of what ultimately evolved into the ANWC's *Directory of Australian Birds*. At the turn of the 1980s, I also arranged to combine the RAOU *Checklist* with the *Zoological Catalogue of Australia* initiated by the Australian Biological Resources Study (ABRS) in Canberra. The scholarship and thoroughness of the *Catalogue's* format attracted me, with its specifications for dates of publication, type specimens, and nomenclatural explanations, well ahead of the Peters-Condon models that we had been using. The land non-passerines—pigeons (Columbiformes) to rollers (Coraciiformes)—were chosen for the first of four volumes for the Aves because their combined families were then the best known taxonomically, and Ian Mason was coopted to compile the Cuculiformes because of his specialist knowledge (Schodde and Mason 1997). At the same time Gerry van Tets and CSIRO colleague Peter Fullagar agreed to start on sea, shore, and freshwater non-passerines. Then, to push the project along in 1983, ABRS gave me a grant to employ Sonia C. Tidemann, now in the Northern Territory specializing in ethnic ornithology, to help in data entry. Against CSIRO advice, I asked ABRS to channel the funds through the RAOU instead of CSIRO as the intermediary institution paying her. Regrettably, the arrangement ended in argument about cuts taken from Tidemann's salary to manage the account, and complaints from the RAOU that I had misused "their" grant when production of the first volume was delayed.

The ABRS *Catalogue*/RAOU *Checklist* project could be described as an experiment that did not quite work. Although we had finished a draft of the first volume by 1985, and most of the passerines and remaining non-passerines by 1988, other ANWC projects proved a constant interruption, so much so that I spent almost a year off-site at ABRS in 1990-1991 to finish revising the first volume. On top of that, compilation of the extensive information required by the *Catalogue*, so valuable for little known groups of invertebrates, was overwhelming for birds because of their vast literature and synonymies. Required information extended from full, text-constipating references for every textual citation to repetitive ecological attributes for each subspecies and to comprehensive referencing of general biological literature, much of which seemed never-ending. In sum, the *Catalogue* for birds tried to do too much. Moreover, its alphabetical sequence of taxa below orders, however appropriate for the Australian fauna as a whole, would never have been accepted in ornithology which, for better or worse, was "hooked" on the classificatory sequences of the day. The RAOU lost patience, and turned to Les Christidis and Walter Boles to produce another species list in 1994, now based in part on the growing number of molecular studies on Australian birds. It was not until 1997 that the first, pigeons-rollers volume of the *Catalogue* was finally published. Despite its trials and tribulations, it remains a basic nomenclatural reference for its contained families in Australia today, and lays the foundation for treatments of the remaining families of Australian birds on the ABRS *Directory of Australian Fauna* website.

The other solution for reliable inventorying down to the level of subspecies was to improve the data base: representative and adequately documented specimen material from across the Australian continent.

For the ANWC, the collections from ecological species studies under Frith, and the regional surveys across northern Australia, as well as from the external territories, the Canberra region, and Kosciuszko National Park, formed a firm nucleus. Constrained by staff, time, and funding, the focus shifted in the early 1980s to south-eastern Australia, from New South Wales to the South Australian gulfs, concentrating on refugial outliers such as the Mt. Lofty Range, and poorly sampled habitats such as the Murray-Darling mallee and mulga belts. Charles Krebs had arrived as Chief of the Division in 1982, and supported the new collecting program.

The year 1983 saw the beginning of another initiative: general collecting of cryo-frozen tissue for molecular analysis. It was sparked by Charles G. Sibley when he visited the ANWC in February to lecture and collect plasma for his global DNA-DNA hybridization studies. I never forgot his pithy comment when shown the growing study-skin collections in the ANWC: "OK, so you've got the envelopes—but where are the letters?" The real catalyst came later that year when I teamed with Peter Baverstock of the Evolutionary Biology Unit of the South Australian Museum and others of his staff, as well as Denis Saunders and Graeme Smith in Western Australia, in a protein electrophoretic study of the phylogeny of Australian cockatoos. It was still early days in the molecular revolution in biological systematics: PCR (polymerase chain reaction) and DNA sequencing were still some years away. I was not a practising molecular systematist, but working with scientists who were led me to appreciate the potential of the procedures, and to realize that, without continent-wide collections of cryo-frozen avian tissues, the research base of the ANWC would be deficient. In any case, tissue-taking made fuller use of killed specimens, in my view an ethical obligation. Large vacuum containers of dry ice or flasks of liquid nitrogen now went on all field trips, although, because the ANWC then lacked storage facilities in Canberra, early collections were sent to Baverstock in Adelaide.

Next year, 1984, brought an even bigger boost. Tom Howell, a past President of the American Ornithologists' Union, took his sabbatical with the ANWC, to work on the biology of woodswallows (Artamidae); and Les Christidis became associated with the ANWC, first as a Ph.D. student in his final year and then formally, from 1985 to 1987, as a CSIRO post-doctoral fellow. Christidis, bright, perceptive, critical and short-fused, was a molecular geneticist who brought molecular system-

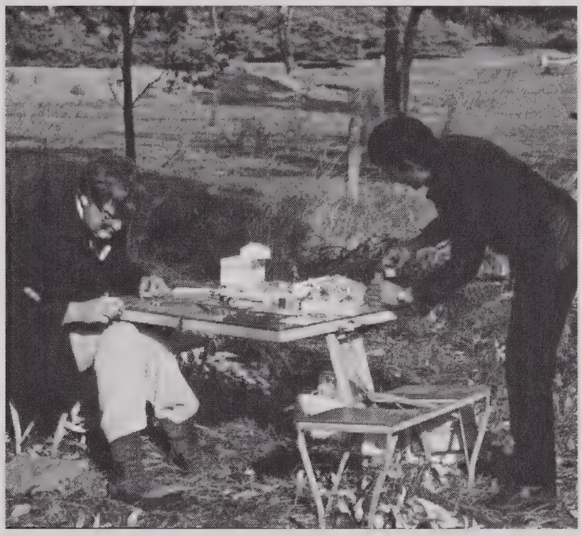

Figure 9. Les Christidis (standing), and Richard Schodde taking tissue samples and making chromosomal preparations of birds at Jindalee State Forest, near Cootamundra, New South Wales, in 1985.

atics to the ANWC for the first time. His area of investigation was the molecular systematics of the songbird families Maluridae and Acanthizidae, and together we planned a number of projects and collecting programs in support. For the ANWC, this meant incoming tissues and voucher specimens of not only malurids and acanthizids, but also material of many other families from all parts of Australia to provide for the future. During 1985, major field trips were undertaken to western Arnhem Land and the Kimberley (Christidis and Wombey), Tasmania (Christidis and Schodde), southeastern Papua New Guinea (Schodde and Christidis), central Australia (Christidis, Wombey, and Gill) and coastal eastern Australia from the Hunter River to Cape York Peninsula (Schodde, Christidis, Wombey, and Gill) (Figure 9).

The three- to four-week trip to central Australia brought back the ANWC's first specimens of Eyrean (*Amytornis goyderi*) and Grey grasswrens (*A. barbatus*) and white-tailed subspecies of the Grey Fantail (*Rhipidura albiscapa albicauda*). Yet it was the five-week expedition along the eastern Australian coast that reaped the greatest

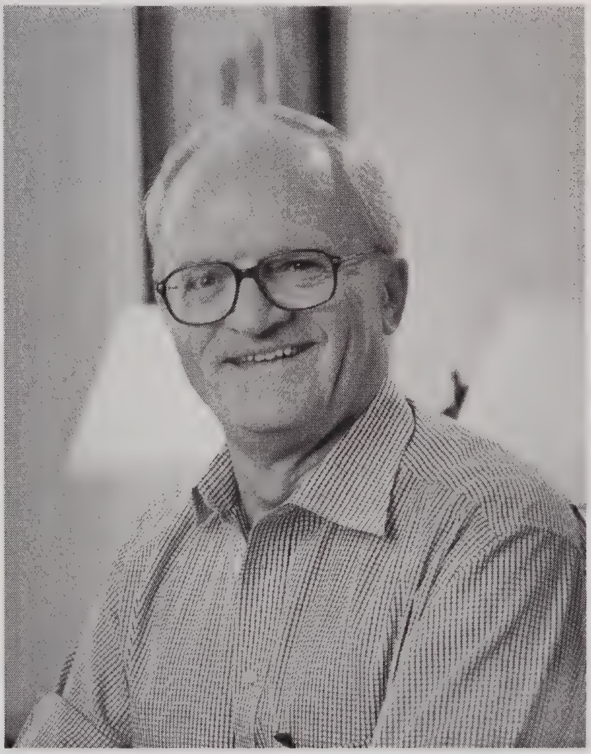

Figure 10. Brian H. Walker, Chief of CSIRO Wildlife and Ecology, 1984-1999.

rewards. Over 200 species were sampled, all selected for potential geographical differentiation from spaced localities along the coast, including such poorly sampled outliers of refugial Bassian habitat as the Kroombit Tops and Clarke Range in central-east Queensland. Our northernmost camp was in summit rainforests of the McIlwraith Range on central Cape York Peninsula, a strange heathy rainforest with towering emergent Hoop Pines (*Araucaria cunninghamii*) studding the ridges. As far as I know, the only ornithologist to have visited the range top was Willrae McLennan briefly over 70 years before. It was alive with birds, Magnificent Riflebirds (*Ptiloris magnificus*) whistling loudly in the trees and Northern Scrub-Robins (*Drymodes superciliosus*) whistling piercingly from the ground. Apart from these species and a sample of local Large-billed Scrubwrens (*Sericornis magnirostris dubius*), the ANWC collected its first Cape York specimens of the Brush Turkey (*Alectura lathami purpureicollis*), Chestnut-breasted Cuckoo (*Cacomantis castaneiventris*), Lemon-bellied Flycatcher (*Microeca griseoceps*), and Green Catbird (*Ailuroedus crassirostris joanae*), as well as an undescribed Lewin's Honeyeater (*Meliphaga lewinii amphochlora*). The way into this strange forest is not west from the coast but east, for seven or eight hours, on an almost obliterated tin-mining road from Coen. In Coen, we stopped for a beer at the pub where an aboriginal woman took a particular fancy to the brooding latin looks of Christidis. It took all our efforts to rush him into our vehicle, lock the doors and drive off, his manhood unmolested.

The years 1987-1988 brought more changes in direction and shifts in staff. Christidis had had to leave, fortunately finding a permanent position as Curator of Birds at the Museum of Victoria, and took with him the tissue collections for on-going research. Apart from several subsequent protein electrophoretic papers with him, direct ANWC involvement in molecular systematics dropped off. Brian Walker, a charismatic and energetic systems ecologist from South Africa who had been appointed Chief in 1984 following the sudden retirement of Charles Krebs, was settling into the job (Figure 10). An astute administrator, he regrouped the old survey program under Calaby in 1986, adding William "Bill" Poole and his assistant Norman Sims who were working on Tammar Wallabies (*Macropus eugeniae*) and parasitologist David Spratt and his assistant Peter Haycock from other programs in the Division. It made sense, because both Poole and Spratt were involved in taxonomic research. But then, almost within the space of a year, Calaby (1987), van Tets (1987), and Gill (1988) retired. These were serious gaps. I was placed in charge of Calaby's program and immediately asked for at least one replacement research position, making a case for a molecular systematist such as Christidis to help take the ANWC forward. It was declined; Divisional funding was limited and there were other priorities.

Leaving the ANWC more seriously impaired curatorially than the departure of Calaby and van Tets was the loss of Gill. In 1988, I appointed John Wombey as Collection Manager, to take over all routine curatorial duties, and approached Ian Mason, now back in Canberra in another program, to return as the Preparator (Figures 11, 13). He agreed; and his transfer was arranged in mid 1988. In another year, 1989, the old survey program was disbanded altogether: Poole and Sims were soon to retire, Spratt was promoted to Assistant Chief, and the ANWC had moved into the Vertebrate Pest Control program under Hugh Tyndale-Biscoe, a strong supporter of the ANWC. This was nevertheless a trying period of adjustment for the staff, engendering feelings that the work of the ANWC was of little importance to the Division while strengthening a sense of camaraderie and purpose among the three of us left–Schodde, Mason, and Wombey. Although below critical mass, we remained the core staff of the ANWC until my retirement.

In Tyndale-Biscoe's program, the ANWC's approach to resolve taxonomic and biogeographic problems in Australia's bird fauna at species and subspecies level through continent-wide sampling of targetted species and regions was renewed. We had by now become closely familiar with the geography of speciation in Australian birds, and I was able, with both sought and unsought advice from Mason, to draw up a blueprint for continent-wide regional collecting, one that identified centres of diversity on the mainland, the suture zones between them and significant islands off the coast. Sampling larger islands off the coast was particularly compelling because differentiation in populations of territorial, non-dispersive land birds there, such as malurid wrens, acanthizids, shrike-thrushes, and some honeyeaters, could be dated by isolation by sea. Tissue collecting, of course, accompanied all sampling.

To complete the program over the next decade before my retirement, one or two major three- to six-week sampling trips were planned a year, each properly arranged and permitted by the States concerned. Rational or not, attitudes to scientific collecting had hardened in the Australian ornithological community through the later 20th century, and questions had been asked in the media and even National Parliament about projected ANWC work on the Superb Lyrebird (*Menura novaehollandiae*) and two specimens of Regent Honeyeaters (*Xanthomyza phrygia*) collected near Canberra before the endangered status of that honeyeater had become really clear. Sensitive to reaction, we learned to work in the shadows and off back roads, and, through Wombey's expertise, loaded our own shot which had the dual advantage of being quieter and less damaging to specimens. To speed operations, we only tissued, tagged, and froze specimens in the field, cross-recorded all data on a newly-developed stamped data form in notebooks, and took the carcasses back to Canberra to process.

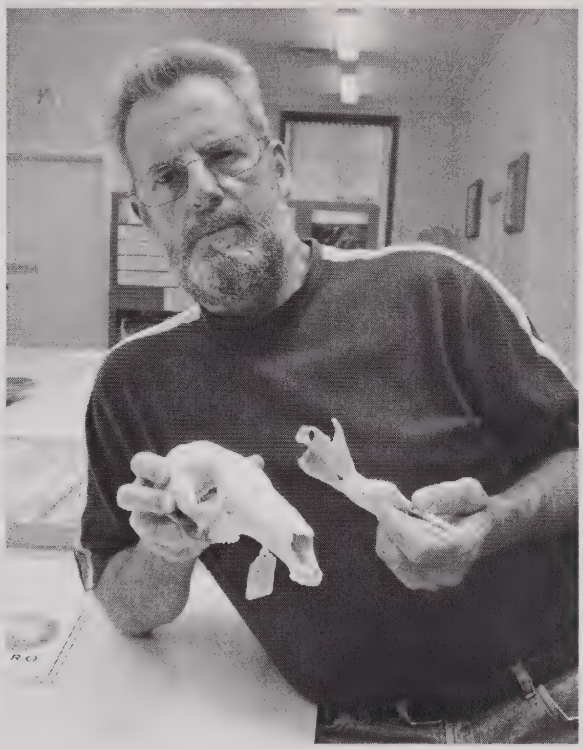

Figure 11. Ian Mason, Fauna Surveyor, 1970-1980, and Preparator, Australian National Wildlife Collection, 1988-present.

From 1988 to 1994, six such expeditions were undertaken, one to central Queensland, another to the Murray mallee and Kangaroo Island in South Australia, two to southern Victoria and South East of South Australia, one to Tasmania and the Bass Strait islands, and one to the South Australian gulfs. Regionally representative material of most eastern Australian species was collected on those expeditions, carried out jointly by Mason, Wombey, and me. The first to Queensland in 1988 was made with a run-down trailer which broke its springs several times and travelled from Normanton to Mt. Isa with a damaged suspension resting on a thick piece of *Acacia* wood, testimony to the toughness of desert species of that genus. Primary objectives of the trip were the (1) Eungella plateau refugium, where the ANWC obtained its first Eungella

Honeyeaters (*Lichenostomus hindwoodi*), (2) the Carpentarian Barrier from Chillagoe and Georgetown to near Burketown at the head of the Gulf of Carpentaria for, *inter alia*, an enlightening sample of intergradient Grey-crowned and Chestnut-breasted babblers (*Pomatostomus temporalis* ssp.), and (3) the Selwyn Range-Mt. Isa refugium, where samples of Cloncurry Parrots (*Barnardius barnardi macgillivrayi*) and Kalkadoon Grasswrens (*Amytornis ballarae*) were collected. The trip ended at Lake Machattie on the lower Georgina River where we confirmed the Grey Grasswren first reported by Leo Joseph. On the way home, a population of Black-chinned Honeyeaters (*Melithreptus gularis*) was discovered on the upper Paroo River intergradient between the southeastern olive-backed and inland northern golden-backed subspecies, burying suggestions that the two were specifically distinct. Prior to the trip, I sent Mason and Wombey (Figure 12) with the

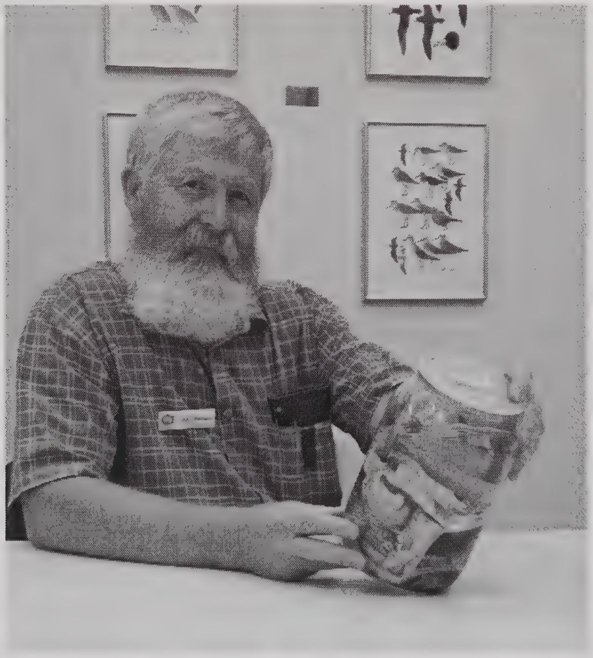

Figure 12. John C. Wombey, Herptofauna Associate, 1970-1988, Collection Manager, Australian National Wildlife Collection, 1988-2000.

ANWC's Chinese M.Sc. student, Duan Yu, to sample variation in Striated (*Acanthiza lineata*), Yellow (*A. nana*) and Buff-rumped (*A. reguloides*) thornbills from throughout their eastern Australian range, putting together much the most geographically comprehensive sampling of these species available today. I tried to ensure that all students with whom I was associated in molecular systematics—Les Christidis, Duan Yu, Janette Norman, and Ian Scott—participated in collecting their own specimens, so that they understood that there was more to the source of their research material than the freezer.

Next year, 1989, we were on Kangaroo Island in South Australia, taking, enroute, type material of the undescribed eastern subspecies of the Regent Parrot (*Polytelis anthopeplus monarchoides*) in the Murray mallee. With the assistance of National Parks ranger Terry Dennis, we collected material of almost all resident and endemic populations of Kangaroo Island birds except the Bush Stone-Curlew (*Burhinus grallarius*) and Bassian Thrush (*Zoothera lunulata halmaturina*). Among them were the ANWC's first specimens of a distinctively dark, endemic subspecies of the Little Wattlebird (*Anthochaera chrysoptera*), as well as the local heavy-billed Glossy Black Cockatoo (*Calyptorhynchus lathami*), and an undescribed subspecies of the Western Whipbird (*Psophodes nigrogularis lashmari*). Discovery that the whipbird was unknown led to a revision of the species which revealed an unexpected pattern of differentiation and formal recognition of the Swan/Darling biogeographic barrier in bird speciation in southwestern Australia (Schodde and Mason 1991, 1999). The much later trip to the South Australian gulfs in late spring 1994 was spent on Yorke and Eyre peninsulas, north to the Gawler Ranges. There we sampled on either side of the Eyrean biogeographic barrier, collecting two subspecies of Grey Currawongs (*Strepera versicolor intermedia*, *S.v. melanoptera*) and intergradient Jacky Winters (*Microeca fascinans fascinans* x *M. f. assimilis*) and the ANWC's first material of the isolated population of the Laughing Kookaburra (*Dacelo novaeguineae*) on Eyra Peninsula.

The two trips to Victoria in the autumn of 1993 and 1994 focussed on the isolated Otway and Strzelecki Ranges in the south, between the Victorian Bassian plain and Bass Strait/Tasmania. Distinctive populations of the Southern Emu-wren (*Stipiturus malachurus*), White-browed Scrubwren (*Sericornis frontalis*), Brown-headed Honeyeater (*Melithreptus lunatus*) and Beautiful Firetail (*Stagonopleura bella*) were found, and material was collected of Gippsland populations of

Lewin's Honeyeaters (*Meliphaga lewinii*) and Large-billed Scrubwrens (*Sericornis magnirostris*) barely represented in Australian museums. On the expedition to Tasmania and the Bass Strait islands of King and the Furneaux Group in the late spring of 1993, emphasis was placed again on sampling island populations and determining differentiation between them and those on the north coast of Tasmania. New subspecies of the Scrub Tit (*Acanthornis magna*) and Black Currawong (*Strepera fuliginosa*) were discovered on King and Flinders islands respectively, and comprehensive sampling of White-browed Scrub-wrens from the Kent Group through the Furneaux Group to the northeast Tasmanian mainland revealed a stepped cline connecting Australian mainland populations with the "Brown Scrub-wren (*Sericornis humilis*)" in Tasmania.

Back in Canberra, three major curatorial problems had arisen by the end of the 1980s and needed urgent solution: the procedures for labelling and registering of collections, storage for the accelerating collections of cryo-frozen tissues, and the curation of over 20,000 skulls of various species of macropodids, dingoes (*Canis familiaris dingo*) and feral pigs (*Sus scrofa*), legacies of the Division's ecological studies of pest species in the Frith years. Up until then, labels and registers were hand-written, but Wombey, brilliant fieldman and a whizz with utility gadgetry, was temperamentally unsuited to sitting at tedious manual routines for long periods; bottlenecks began to develop in specimen processing. It was time to computerize, something that did enthuse the Collection Manager and which he had been urging. I had tried to develop a computerized collection data base in the early 1980s in collaboration with the central CSIRO Division of Computing Science, but writing the software proved difficult and the project collapsed. For PCs at the end of the decade, however, a number of data-basing programs were available: computerization was now do-able. We wanted a single unified system that would store data and print both register sheet and specimen label that was both atmosphere and ethanol proof; and, after the fields and required label size were settled, Wombey and Mason developed the system. From the turn of the 1990s on, manual labelling and registering was limited to a single point of data transfer, from field notebook to PC. It was a routine to which Wombey took like a duck to water. To my knowledge it was also the first introduction of a computerised labelling process for ornithological collections in Australian museums.

When the ANWC began planning for storing cryo-frozen tissue samples in the later 1880s, DNA sequencing technology had not yet replaced other molecular procedures such as protein electrophoresis; and for the latter only storage in liquid nitrogen prevented sample degradation over time. So, to cover all bases, liquid nitrogen storage was chosen; and for it a large insulated storage tank was purchased in late 1987. The Division, however, had no on-site supply, and every week or two, Wombey had to drive off-site to bring back containers of the fluid to top up evaporation from the tank. The exercise was costly in time and funds. By 1991, DNA sequencing had taken over altogether, and so, with Christopher Collett's concurrence, an upright -70ºC freezer was purchased for his impending move to the ANWC. Collett, a molecular geneticist, was one of two staff that Tyndale-Biscoe planned to transfer to the ANWC to assist in its projects. The other was bat expert, Gregory Richards, whom I promptly put in charge of the chiropteran collections on his arrival in 1991 and who, in his time with the ANWC, produced a unique electronic sound system for detecting and identifying microchiropteran bats at night. In the end, Collett did not join, even though funding and equipment had been obtained with Tydale-Biscoe's support to establish a genetic finger-printing laboratory for him. His transfer was delayed for over a year, by which time support funds had evaporated.

Not so easily curated were the ANWC's large mammal skulls. While the mammal study-skin collections and the skulls and skeletons of smaller mammals were secure in the ANWC's vaults, the vast collections of large mammal skulls from the early ecological studies were still dispersed about the Divisional site, in corridors, sheds, and outhouses, many of them in 44-gallon drums part-exposed to the elements and deteriorating. They were irreplaceable: long series of dated age and sex classes from precise localities that could never be collected again. All were cleaned and field tagged; all that they needed was to be sorted, data-based, labelled, and incorporated into secure storage where each could be tracked—every one of the more than 20,000. The task ultimately took ten years, begun by Lesley Eagles employed temporarily on grant money and finished by Wombey.

A direction from the Australian Government in the late 1980s that CSIRO raise up to 30% of its funding from external sources had a fundamental impact on CSIRO Wildlife and Ecology (as CSIRO Wildlife Research was now known), its research programs and the ANWC. For those Divisions already linked with the private sector, such as the building and construction industry and product production, this was of relatively little consequence. But for Divisions whose research was more in the public interest, the base for external funding was far more limited. CSIRO Wildlife and Ecology, with its focus on wildlife and environmental conservation, education, and management, lay almost at the bottom of the pile; and for the ANWC, which provided background, not foreground information in this area, the situation was even more perilous. It had the effect of redirecting research into areas of narrow, sectional interest and of disrupting sound strategic investigation, such as the ground-breaking correlations that Wayne Braithwaite was finding between soil fertility and richness of biodiversity in Australia's forests. It also created gross inefficiencies in the production of scientific information. Scientists had to behave as business entrepreneurs, something for which few were equipped. The equation said it all: scientists spent up to 70% of their time chasing 30% of their funding while the taxpayer got 30% of research production for 70% of outlay.

The ANWC responded by seeking contracts for environmental impact surveys, particularly in biogeographically significant areas. By collecting voucher specimens required by survey protocols, it could also further its goal of preserving a comprehensive record of Australia's higher vertebrate fauna. The team for these surveys comprised all ANWC staff, including Greg Richards for bats, plus Peter Catling and the veteran R. J. "Mick" Burt from another Divisional program for ground mammals. In late 1989, the first survey began, commissioned by mining giant Geopeko, and covering the coastal lowlands of the McIlwraith Range on Cape York Peninsula, underneath the scarp on which I had worked with Christidis, Wombey, and Gill in 1985. The survey was called off six months later because of a dispute with local Aboriginal landholders over access rights, but not before representative material of most regionally distinct birds on Cape York Peninsula had been collected, including the Yellow-legged Flycatcher (*Microeca griseoceps*), Yellow-billed Kingfisher (*Syma torotoro*), and Green-backed (*Glycichaera fallax*) and White-streaked honeyeaters (*Trichodere cockerelli*).

Next year the then Electricity Commission of New South Wales commissioned the ANWC under CSIRO Wildlife and Ecology's Wayne Braithwaite and his group of Mark Clayton and Mal Stanger in a survey of the proposed route for a high-power transmission line from Coffs Harbour to Grafton in north-eastern New South Wales. It was followed by a major survey of the vast Shoalwater Bay Training Area in central-east Queensland for the Australian Department of Defence, facilitated by Brian Tunstall of CSIRO Land and Water. Excluding supplementary reports, that survey spanned all of 1991 and 1992 and involved all ANWC staff, as well as Catling and Burt, Braithwaite's group, and Graeme Chapman, then Divisional wildlife photographer. The ANWC led this survey, and vouchers of the regional bird fauna were collected, including samples from a mixed population of Little Bronze-Cuckoos (*Chalcites minutillus russatus* and *C. m. barnardi*) and the southernmost normal-range records of the Buff-breasted Paradise-Kingfisher (*Tanysiptera sylvia*). It almost cost me my life when a road on which I was being driven collapsed, over-turning the vehicle which threw me out and rolled on me.

Despite short staffing, the distractions of contracted survey reporting and a shift to yet another Divisional program under ecologist Graeme Caughley in 1992, the research and development program for the bird collections of the ANWC began to settle into a smooth operational groove in the early 1990s. Income from surveys was augmented

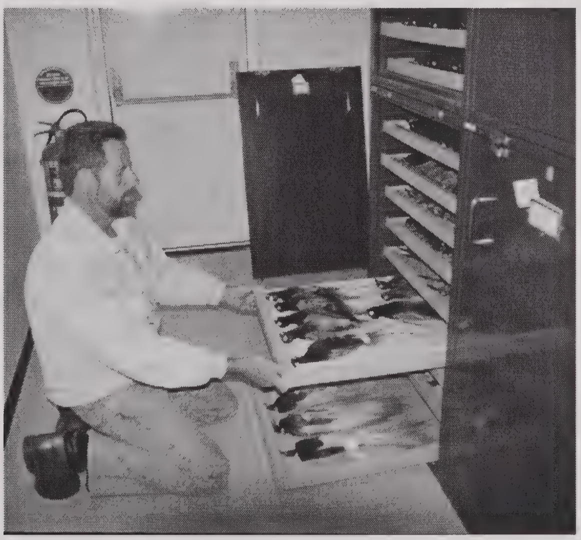

Figure 13. Ian Mason laying in specimens in the Australian National Wildlife Collections vaults. The specimens in the tray are birds-of-paradise from the ANWC's New Guinean collections.

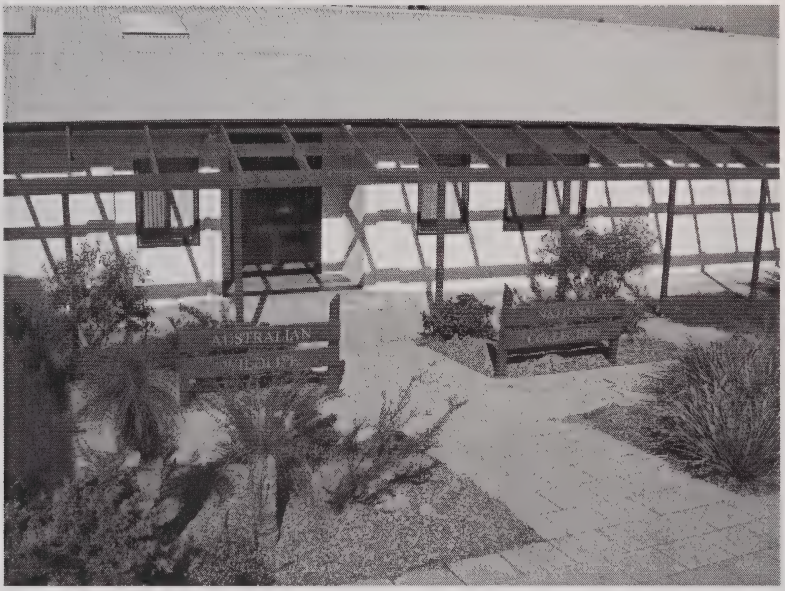

Figure 14. The present home of the Australian National Wildlife Collections, first renovated in 1991 and extended in 1996.

substantially by internal grant money from a procedure known as "research accountability," which was introduced by Chief Brian Walker to reward productive scientists. Based on scores for published papers, science citation indices, and external communication, the ANWC had always done well in the system, and when Richards joined it in 1991, it earned ample funding for basic ANWC maintenance, equipment, and storage, with enough left over for vehicle purchases, the field program, and research travel. In effect, the ANWC was being run on internal grant earnings.

By 1989, the ANWC's first building was bursting at the seams, and could not cope with the large mammal skulls now being brought together from around the Gungahlin site. Moreover, Chief Walker needed a home for his new climate change laboratory. So renovation of another more distant but larger building was ear-marked for the ANWC: Frith's old cement-block animal house (see p. 321. It was a barn of a building, and reeked of mammal urine; but if properly gutted, redesigned, and refurbished, it could be turned into a sound and secure facility for holding a national heritage collection. This was accomplished. I was given a free hand in its redesigning and allowed a large extension to house the bird study-skin collections; for the first time, air conditioning was ducted to all rooms. Contributions of original paintings from artists who had used ANWC specimens for their own work were called in and arranged alongside displays of the work of the ANWC to decorate the walls of the main workroom. The Divisional library of wildlife sounds was incorporated as well, in a dedicated suite comprising an office and alcove for storing the analogue tapes and, later, analogue and digital compact discs. Peter Fullagar, who inherited the facility from Norm Robinson in the 1970s, had kept it in well-ordered condition in other rooms on-site. Now that he was retiring, we arranged for it to be brought across and for him to continue its curation as an Honorary Fellow. To celebrate the new home for the ANWC, brochures were produced advertising the values of the ANWC's specimen and sound collections; and the building was opened by the then Minister for Science, the Hon. Ross Free, in December 1991. A silk purse had been built out of a sow's ear; yet, although a big step forward in the housing of the ANWC, the building was not yet large enough to hold the skeleton and spirit collections or preparatorial facilities (Figure 14).

A month or so before the opening, when the rest of the ANWC staff were in the field on the Shoalwater Bay survey, I attended a Pacific Conservation Congress in Brisbane to hear an address from senior Western Australian faunal administrator, Andrew Burbidge, on the importance of faunistic inventories as bases for biodiversity management. It sparked a turn-around in my approach for producing routine species-subspecies revisions to support the *Zoological Catalogue of Australia*, shifting it to diagnosing subspecies with maps and details of distribution, required habitat, and estimated conservation status. It was the beginning of *The Directory of Australian Birds*, and I prepared the acronyms for habitats even before returning to Canberra. Chief Walker approved the project in early 1992, which was to start as soon as the Shoalwater Bay survey had been finished; and in 1993 Mason was co-opted to prepare the maps, take and collate my measurements with his, and cross-check the taxonomies of my texts against the increasingly representative collections of the ANWC. By mid 1994, a third of the text had been completed, from pittas to honeyeaters and about half the acanthizids. I can remember driving home one evening, thinking complacently: "the ANWC was settled in new quarters, we had gone a long way in fulfilling obligations for external earnings through contracted surveys, the field collecting program was rolling along supported by internal accountability funding, the first bird volume for the ABRS *Zoological Catalogue* had gone for final editing and type-setting, and the text of passerines for the *Directory of Australian Birds* was on track to finish by the end of 1995—it all seemed to too good to continue." And it was.

The perils of K-selection (mid 1994 – early 1997).—In June 1994, Chief Walker called together all staff members who had been involved recently in contracted environmental surveys—ANWC staff, Wayne Braithwaite's group, and Catling and Burt—to deliver news of a Divisional initiative. We were all to be amalgamated into a new Divisional survey program, "X", charged with raising revenue for Divisional research generally by contracting for environmental impact assessment and related commercial work. We needed, so we were told, a complete change of mindset in approach to research, and had to become entrepreneurial in business and seek contracts; a new program leader would be appointed from the private sector to lead us in the ways of the commercial world. To launch the program, we were wined and dined at The Canberra Club. In retrospect, those weeks seem as bizarre as unreal. When I asked at the original meeting what would happen to the curation of the ANWC and development of its programs, I was told that I should consider them on hold, but that after revenue targets were reached each year, we could return to them, estimated at 20-50% of our time. Revenue targets, of course, were such that they were impossible to reach.

In the frame of changing research priorities in the Division towards ecosystem management and environmental sustainability, the ANWC had stayed stubbornly put on conducting a biodiversity inventory program and building a reference collection. Such work was considered to be of low priority. Faced with financial constraints, the Division needed to use staff on projects that would bring in revenue, and the new survey group involving Wayne Braithwaite and the ANWC staff had already proved itself effective in contracted environmental impact assessment (EIA). This and an option—that we could return to our original research projects if, after a fair trial period, the new arrangements did not work out—prompted us, uncertainties notwithstanding, to "give it a go."

The first—and last—EIA contract to involve the ANWC under Program X was a survey in 1995 of the land vertebrate fauna of the Murwillumbah Management Area for State Forests New South Wales. The area covered the extraordinarily biodiverse refugial rain- and eucalypt-forests of the McPherson, Tweed, and Nightcap Ranges around the volcanic Mt. Warning caldera in far north-eastern New South Wales, in a region that had actually been marked for fauna survey in the Frith years. Field sampling was carried out in summer and early winter for what proved to be the largest and most complex survey report ever produced by the Braithwaite-ANWC-Catling group. For birds, small but valuable voucher samples were gathered of the Sooty Owl (*Tyto tenebricosa*), Albert's Lyrebird (*Menura alberti*), Eastern Bristlebird (*Dasyornis brachypterus*), and White-eared Monarch (*Monarcha leucotis*), as well as altitudinally allopatric Bassian (*Zoothera lunulata*) and Russet-tailed (*Z. heinei*) thrushes from the top and bottom of the Tweed Range respectively. Fresh material of the bristlebird revealed an undescribed subspecies (Schodde and Mason 1999).

Survey staff had to be expanded to cope with the size of the project. Allen Kearns, with considerable experience overseas in environmental impact work in the private sector, had been appointed to lead the program, and the ANWC was fortunate to gain the services of Wayne Longmore, a long-time experienced field and museum ornithologist at the Australian and Queensland Museums. In the periods between field work, Longmore and I sorted regrouped the bird skeleton collection which was by now as comprehensive as any in Australia, and separated out the fragmentary and fragmented material that had been used by van Tets in his taphonomic studies. The entire collection was re-boxed for a move to state-of-the-art storage in further extensions to the ANWC building. By 1995, it was the Division's turn in the CSIRO laboratory renovation cycle: all the makeshift cement-block wings put up by Frith in the 1960s, including his historic office, the alcoves and rooms for ANWC spirit and skeleton collections, and the ANWC preparatorial rooms, were to be demolished and replaced with a new library and communications complex.

Extensions to the new ANWC building were the logical option. Architects were brought in and designed large and specially ventilated rooms for the spirit and skeleton collections, a spacious and superbly equipped preparatorial room with a new cryo-freezer with modular storage, and a large extension to the bird study-skin vault. All were attached to the ANWC in a way that left an attractive quadrangle in the centre of the building for a garden and facilities for relaxation. There was now space to incorporate all ANWC study-skin, spirit, cryo-frozen, skeleton, and mammal skull collections under one roof, in conditions of climate-control, lighting, and shelf storage second to none and sufficient for at least several decades of expansion. A large loading ramp and platform, and a sealed specimen-fumigation vault, were built at the back; and the front of the building was landscaped and sign-posted. For the first time in its short life, the ANWC had an air of overt physical reality. I indulged a whim by planting Gondwanan plants on one side of the internal quadrangle (*Nothofagus*, *Tasmannia*) and Australian sclerophyllous plants on the other (*Xanthorrhoea*, *Anigozanthus*).

Offsetting the élan from first-class accommodation was the drag of routine report writing for the Murwillumbah EIA. Assessments of the status of gazetted threatened taxa formed the core of the report, and in a protocol that required accurate and complex information. If there were a dozen or so such taxa each for amphibians, reptiles, and mammals, there were over 40 for birds. Falling largely to me, the bird section proved a frustrating bottleneck: the report took more than eight months to complete, was overdue, and left ANWC staff disenchanted. Furthermore, no further contractual work had appeared on the horizon. Not only had we been too tied down to look for more, but most EIAs were now being awarded to university departments at considerably lower rates because student labour was cheaper; and, in any case, such work was drying up with changes in government and shifts in policy. In autumn 1996, Catling and I exercised our option of returning to our previous research programs and projects, and the ANWC revitalised itself with two regional sampling trips.

One, undertaken by Mason, Longmore, Graeme Chapman, and me in the autumn of 1996, ran from the central Darling River in New South Wales via the Strzelecki Desert in South Australia to Longreach in central Queensland, criss-crossing between Murray-Darling and Lake Eyre basins to assess the role of the Grey Range barrier in fostering avian differentiation on either side. Swarming bush flies made field work uncomfortable and frustrating by day, at times causing staff to process specimens in sealed vehicles in 40°C heat. Later that year, the ANWC sent Mason and Wombey on the other trip, to its last major island, Melville, by arranging to piggy-back on a collaborative expedition with the Northern Territory Museum and Art Gallery. They collected a comprehensive range of Melville Island endemics, including an undescribed subspecies of the Yellow Oriole (*Oriolus flavocinctus*). On their return journey, I flew to Alice Springs to meet Mason to collect specified refugial species in the central Australian ranges, including the local populations of the Red-tailed Black Cockatoo (*Calyptorhynchus banksii*) and Galah (*Eolophus roseicapillus*), and, in northern South Australia, the Chiming Wedgebill (*Psophodes occidentalis*), White-plumed Honeyeater (*Lichenostomus penicillatus*) and even House Sparrow (*Passer domesticus*).

The Division was still in financial straits. Program "X" was disbanded in mid 1996. Wayne Longmore left, Allen Kearns was promoted to Assistant Chief, and, to save money, the Divisional executive had taken to offering redundancies to staff in areas outside the core scope of Divisional research. The older specialists in single species ecology, animal physiology, and Wayne Braithwaite with his unique understanding of forest ecosystems were targetted, all straws in the wind. When, in 2003-2004, criticism appeared in the press about the demise of wildlife research in the Division, it overlooked the events of the 1990s when the seeds of the shift were sown. Because of requirements to earn external revenue and a perceived need to focus on sustainability in rural landscapes, the shift was really initiated then. Chief Walker, as was his prerogative, saw that direction as more fundamentally important. The ANWC itself, using up funds and resources that might be better employed elsewhere, was set for review, its first, on 21-22 November 1996.

Then at 60, I was planning to retire within several years. Preliminary briefings for the review from the Division's Secretary, Brian Jackson, prepared me to focus on the values and achievements of the ANWC and its immediate development pending appointment of a new Curator and research leader. I also urged that zoological systematists and museologists familiar with the work of the ANWC be appointed to the panel. None was, but my recommendations—David Ride, executive Commissioner on the International Commission of Zoological Nomenclature, and Ebbe Nielsen, Director of the Australian National Insect Collection at CSIRO Entomology—were interviewed. So was Des Griffin, Director of the Australian Museum in Sydney, which I thought a little strange given the cost of flying him in for a brief discussion. The panel comprised senior Divisional officers—Stephen Moreton as chair, Allen Kearns, Dave Spratt, and administrator

Jackson—with only one external person: Judy West who, as head of the Australian National Herbarium, Canberra, was hardly external. I was the last to be interviewed. Instead of questions about ANWC achievements and general development, I was quizzed about how I thought the ANWC fitted into the Divisional research program, and how collaborative integration could be achieved with other Divisional projects. In response, I stressed the value of the ANWC as a data-base for determining and inventorying vertebrate biodiversity at both local and continental scale, thereby anchoring the Division's authority in biodiversity research. But, mindful of my prior briefing from Brian Jackson, I withdrew from more than a broad outline of potential research collaboration with other Divisional prgrams. That, I felt, was properly the province of my impending replacement and preferably, I added, someone with competence in molecular analysis. I left the review in disquiet.

Disquiet was justified when, two days before Christmas 1996, the report of the review came down like a bomb. The panel, with Chief Walker's approval, noted the great value of the ANWC collections, particularly its birds, but found its research to be peripheral to changing Divisional directions, and recommended that, without other support, it should be "moth-balled" and partially dispersed. In discussions, and in the report, the Australian Museum, a New South Wales state institution, was mentioned as a possible repository or partner. ANWC staff were dumbfounded. It was not so much because of any personal repudiation, or misconceptions of collection value, curatorial process, and scientific links expressed in the report, but that a panel largely uncredentialled in animal museology could pass judgements that would emasculate and potentially dissolve a nationally-gazetted biological collection of international standing and heritage value. Of Australia's great bird collections, the Gould had gone to Philadelphia and the Mathews to New York—would this be a third?

I contacted other senior scientists in other CSIRO divisions for advice, only to be told that in such matters chiefs invariably have their way. There is good reason for this. In CSIRO, chiefs are chosen for their eminence and capacity to lead in their general areas of research, and they are given considerable freedom to shift and redevelop research programs to meet changing needs and new directions in their brief decade or two of office; stewardship is not of primary concern. But the ANWC was not just a temporary research program; it was an institution gazetted by the Australian government for the long term. Nor was its function just to conduct research on vertebrate biodiversity; it was also to gather, manage, and protect reference and heritage collections in the national interest. Its gazettal in 1976 had vested the Division with responsibilities for its safe-guarding and development, not its dissolution. In this context, the disconnection between the ANWC and immediate Divisional research directions, which were the main grounds used by the Review Panel for its recommendations, were largely irrelevant. So I resolved to contest the issue with support from David Ride, Doug Waterhouse, former Chief of CSIRO Entomology, and many overseas colleagues, together with practical help from Ebbe Nielsen. I was fortunate also for positive counsel from Dan Walton, adviser to the Director of the Australian Conservation Agency, as well as the now Librarian of the Australian Parliament, Roxanne Missingham, and Wayne Braithwaite. The Council of Heads of Australian Fauna Collections, of which I was a member, also weighed in.

Of the three hurdles to dissolution of the ANWC, the first two—government gazettal and reaction from the other national biological collections in CSIRO—were largely contingent on the third: approval from the then CSIRO Deputy Chief Executive for the biological sciences, John Radcliffe. When informed of the review panel's conclusions, he quickly gave notice that he needed to visit and assess the ANWC himself, pointedly observing that the panel had comprised largely internal Divisional officers. Radcliffe, like me, was Adelaide-born and -bred, and had known my family since primary school. Yet it was not that which gave me some hope of saving the ANWC, but his natural interest in Australian museums and heritage values: he had been a member of the Council of the South Australian Museum. With permission from Chief Walker, I wrote him a memo signed by Mason, Wombey, and me stressing the significant components of the ANWC collections, the science that they supported, and the heritage value and irreplaceability of the specimen material. Then we busied ourselves to put the best front possible on the ANWC. Radcliffe visited it in the last week of January 1997, to be shown comprehensive, immaculate, and thoroughly documented collections of Australian and New Guinean vertebrates in state-of-the-art curatorial facilities in a gleaming, newly extended building that had just been renovated at a cost of several million dollars.

His judgement, handed down later in February 1997, turned the fortunes of the ANWC around and reached further to shore up the security of CSIRO's national biological collections as a whole. Not only was the ANWC to be retained by CSIRO and kept operational by the Division, but the heads of all national biological collections were to form a committee for mutual communication, support, and collaboration. The episode had exposed the vulnerability of the national collections when functioning alone: dissolution of the ANWC could be a precedent for others. It was only natural, however, that some tension and mistrust remained between the ANWC and the Divisional executive. At meetings of the heads of the national biological collections that followed, I was always accompanied by another senior Divisional officer, first Steve Morton and then Denis Saunders.

Little changed through early 1997 and I began talking with Ebbe Nielsen about shifting the ANWC under the aegis of the Australian National Insect Collection. For both of us it was an obvious solution: if CSIRO Wildlife and Ecology no longer felt committed to fostering the ANWC, then it made sense to attach it to one of the other biological collections that did. Indeed, one might ask why this course was not considered, let alone explored, in the ANWC review. It would have been the first practical step towards merging the national biological collections into a single national history museum.

Merging the ANWC with the Australian National Insect Collection was the option that I subsequently canvassed at CSIRO head office later in 1997. Before a day or so had passed, I was approached by Chief Walker to think about retiring "soon." As he put it, the ANWC needed a renaissance with new directions and leadership in molecular technologies, and status and skills to attract students and post-doctoral fellows—see the last paragraph of the ANWC inset in the official history of the Division (Anonymous 1999). I held my tongue, thinking of the positions taken from the ANWC over the previous decade and my rejected attempts to get staff and replacements in molecular technology that would do just this.

Pressure for retirement was nevertheless kept up, and I had two meetings with Walker in his office where, surrounded by a panel of other members of the Divisional executive, I was urged to retire "for the sake of advancing the ANWC and to ease the Divisional funding problem." At the second meeting, Roxanne Missingham, as CSIRO Staff Union representative, and Ian Mason resolved to come with me for support, bringing with them a tape recorder to document the proceedings. I dug my heels in about retiring *before* a replacement was appointed because of fears, justified or not, about what might happen to the

ANWC if I did; and Mason and Walker launched into a heated exchange over the Division's treatment of the ANWC. It said much about Mason's character: even though out-pointed in the argument, he was loyal and game. And the matter of my retirement never arose again.

Directions established (1997-2000).—Thereafter relations began to mend, led by positive and constructive initiatives from Chief Walker. We had discussed setting up a Foundation modelled on the Australian National Insect Collection Foundation to support and watch over the ANWC. Walker now took the opportunity of using most of a bequest of $400,000 from Sydney artist, Sonia Farley, for seed funding to set up the Foundation and appointed Assistant Chief Denis Saunders to the task. I now reported to Saunders in the Divisional executive, a relationship that soon warmed and became mutually supportive. Saunders, an able and well-connected administrator, focussed on developing the ANWC Foundation and promotional issues, leaving me largely to my traditional role of running the ANWC; but inter-communication and -consultation was constant, particularly in areas involving ANWC development. In July 1998, the Foundation was established with a Board of Governors of eminent persons in commerce and the community, chaired by Charles Allen, then Chairman of CSIRO, and comprising John Foote as Managing Director of DuPont Australia, and Ms. Lindy Hayward of the Myer Foundation. One of its first actions was to secure a grant of over $200,000 for several years from the Myer Foundation to establish laboratory facilities and technical staffing for molecular systematics for a new Curator/Director of the ANWC.

Later in 1998, the position of Curator-in-Charge was advertised, asking for molecular expertise, experience in bird systematics, and entrepreneurial skills. Emphasis was placed on the Aves for two reasons: first, they comprised the major research strength of the ANWC collections, and second, due to their diversity and range of niches occupied, birds were the most effective biodiversity indicators among Australian vertebrates for Divisional landscape ecology programs. Signs of how far the ANWC had now come, and how high its reputation, are reflected in the calibre of some of the applicants: Scott Edwards, now Agassiz Professor of Zoology at Harvard, Les Christidis, now Assistant Director of the Australian Museum, and Adelaide-born Leo Joseph, then in charge of the bird collections at the Academy of Natural Sciences, Philadelphia. Edwards was appointed, but soon withdrew; and in his place, Joseph was chosen on the understanding that he would have a year's grace before taking up his position.

Adding now to ANWC commitments in research and development were increasing promotional and marketing issues. My meetings with consultants for sponsors, media interviews (and personal training for them), promotional functions, production of new brochures and a logo (with considerable help from Fullagar), and ground work for developing an ANWC website (originally with help from Roxanne Missingham and Dan Walton), became never-ending. We even conceived the idea of bringing the historic Gould Collection of Australian birds in Philadelphia to Australia for a joint ANWC-Philadelphia-sponsored exhibition; negotiations were opened and proposals written, only to lapse by 2000. With support and advice from honorary sound curator Peter Fullagar (Figure 15), I arranged for the Ray Swaby collection of Australian and New Guinean bird sounds, perhaps the largest collection of Australian bird sounds in the world, to be copied onto disc and

Figure 15. Peter J. Fullagar, Sound Library Manager, 1991-present.

deposited with original tapes in the ANWC sound collection. Fullagar also continued gathering more from other colleagues, including David Stewart in north-eastern New South Wales. Today the ANWC sound collection contains almost 60,000 recordings of bird sounds, by far the largest in Australia; the Swaby Collection alone fills 600 CDs. Fullagar and, later, associate Tony Howard, used the resource for writing and editing bird voice sections in the monumental 7-volume *Handbook of Australian, New Zealand and Antarctic Birds* (1990-2006) produced by Birds Australia.

Yet the core business of the ANWC had to continue. The first Aves volume of the *Zoological Catalogue of Australia* (37, 2) was seen through to publication in early 1997, and in the same year the ANWC teamed in a project led by Malcolm Stanger and Mark Clayton of Braithwaite's group to produce the *CSIRO List of Australian*

Figure 16. At the launch of *The Directory of Australian Birds, Passerines* at the Myer mansion, Melbourne, November 1999. Left to right: Charles Allen, Chairman of CSIRO and Chair of the ANWC Foundation, Ian Mason, Richard Schodde, and Norman B. Wettenhall, representing Birds Australia, holding a copy of the work.

Vertebrates, a species list with conservation status. Mason and I had also returned to passerines for the *Directory of Australian Birds*. Because of my new "marketing" commitments, I had less time for analysing the new problem-solving collections brought into the ANWC over the last several decades, and Mason took to laying out the specimens for preliminary assessment. These I would then check and note independently myself before returning to the desk with his notes and mine, together with my own earlier records from interstate museums, to rework, modify and resynthesize before writing up. It was not a perfect arrangement, but it did speed the task. By the end of 1998, all revisionary work was finished, and I had put together the introductory chapters and Mason the references. Even so, the *Directory* was not published until the end of 1999 due mainly to editorial misadventure at the publishers, generating another problem (Figure 16). One of the external referees lifted summary details of many subspecies that, because of the delayed printing of the Directory, led to their prior publication in his own field guide. While some Divisional staff objected strongly and I professed concern, I nevertheless took it as flattery by imitation and good advertisement.

The collecting program also picked up again, with Mason, Wombey, and me as the core team. Between mid 1997 and late 1999, we undertook five major trips. The first to the Flinders Range, Gawler Range, and Eyre Peninsula in South Australia once more sampled either side of the Eyrean zoogeographic barrier. We gathered material of isolated populations of the Rainbow Lorikeet (*Trichoglossus haematodus*), White-winged Chough (*Corcorax melanorhamphos*), and Western Gerygone (*Gerygone fusca*) there; the record of the gerygone in the Flinders Range was new. An isolated population of the Red-rumped Parrot (*Psephotus haematonotus*) on the Frome River in the northern Flinders was also sampled. Two shorter subsequent trips through central and western New South Wales resulted in collected Chirruping Wedgebills (*Psophodes cristatus*), Spotted Bowerbirds (*Chlamydera maculata*), Pied Butcherbirds (*Cracticus nigrogularis*), and White-browed Treecreepers (*Climacteris affinis*) at the south-eastern limits of their range. We also sampled the intergrade zone between red- and yellow- vented subspecies of the Bluebonnet (*Northiella haematogaster*). Incoming Curator/Director Leo Joseph and Wayne Longmore joined the group for an intensive point-by-point sampling of the eastern coastal scrubs and mangroves of Queensland between Mackay and Cooktown in autumn 1999, across both Burdekin and Torresian zoogeographic barriers. This expedition obtained critical material of Orange-footed Scrubfowl (*Megapodius duperryi*), Striated Herons (*Butorides striatus*), Little Bronze-Cuckoos (*Chrysococcyx minutillus*), two subspecies of Chowchillas (*Orthonyx spaldingii*), Black Butcherbirds (*Cracticus quoyi*), Mangrove Robins (*Peneoenanthe pulverulenta*), Helmeted Friarbirds (*Philemon buceroides yorki*), and Blue-faced Parrot-Finches (*Erythrura trichroa*), as well as many other species. Specimens intergradient between orange- and blue-orbital skinned subspecies of the Squatter Pigeon (*Geophaps scripta*) and between Large-billed and Tropical scubwrens (*Sericornis magnirostris* x *beccarii*) were also collected, together with evidence that Mangrove (*Lichenostomus fasciogularis*) and Varied (*L. versicolor*) honeyeaters were separated at the Burdekin Gap with little or no intergradation.

One of the sampling objectives of the eastern Queensland expedition was the Big Tableland several kilometres east of Helenvale, the northernmost outlier of the montane north-eastern Queensland rainforest belt. As soon as we entered private property at the base of the tableland off the Helenvale road, we approached the landholder with the routine request for access and permission to collect. The response was unusually cautious and mistrustful: “do you have a permit?” When the permit was duly produced, he added: “OK, but the last bloke who came here to collect birds didn’t have one and we had to call the police.” By sheer coincidence, we had chanced upon the very place where Australian bird systematist Julian Ford was apprehended for illegal collecting in late 1986. At the International Ornithological Congress in Ottawa the previous June, he and I had discussed bureaucratic delays that he was experiencing for his permit for his impending collecting trip to Queensland. He had a receipt for the fee accompanying his application, and this he intended to use as the “permit” if official approval was not forthcoming: it was a strategy that he had used on a previous collecting trip through Queensland a decade earlier. The Queensland Department of Environment and Heritage, I knew from experience, was notoriously slow in processing permits, so I urged him in the strongest terms to go to Brisbane and sit in the permit office until his was issued: it was a ploy that had worked for me in the past. But that did not fit Ford’s itinerary, nor his stubborn sense of what was right and fair.

Showing us the sobering site of Ford’s arrest, the landholder explained that Ford had arrived on the property simply with a request to camp for a day or two and do some "work" on birds. When the landholder awoke to the sounds of repeated gunfire from around Ford's camp next morning, he became suspicious. Later in the day, after Ford had driven into Helenvale for supplies, he stole into the camp to find series of drying specimens, packages of bird study-skins, and a small fridge filled with fresh bird carcasses of an extensive range of species. Thoroughly alarmed, he rang the police in Cairns where, by chance, a unit of the Queensland flying squad was present that day; the squad left at once, racing to the camp to catch, as they put it, a "biggee" red-handed. The rest of this tragic story is history, making even the "60 Minutes" report on Australian national television. Badly advised by legal counsel and poorly supported by members of Australia's scientific community, Ford thought he and his family would be ruined financially; and early in 1987 he took his own life before the case could come to court. Australia had lost a foremost analyst of geographical variation in birds.

By now, the ANWC had thoroughly comprehensive collections from most of northern, central, eastern, and southern Australia, but little from the west. In late November 1999, then, it undertook its first extensive collecting expedition in south-western Australia, working either side of the Swan/Darling zoogeographic barrier, and obtaining comprehensive samples of the south-western Australian populations of the Regent Parrot, Australian Ringneck (*Barnardius barnardi*), Elegant Parrot (*Neophema elegans*), White-browed Babbler (*Pomatostomus superciliosus*), Western Wattlebird (*Anthochaera lunulata*), Yellow-throated Miner (*Manorina flavigula obscura*), White-cheeked Honeyeater (*Phylidonyris niger*), Australian Magpie, and Grey Currawong (*Strepera fuliginosa plumbea*). In my last year, I drew up, in consultation with Mason, a list of the remaining regional gaps, highlighting the Pilbara, western Cape York Peninsula and the Kimberley. These gaps were later filled under incoming Curator/Director, Terry Chesser, early in the first decade of the 21st century.

So far neglected in the development of the ANWC were its egg collections, and in 1999 that was about to change. Being of somewhat peripheral value to systematic and zoogeographic research, active egg collecting was not part of the ANWC's program. Yet eggs, particularly complete clutches, are part of the record of Australian bird biology and a proper component of any heritage collection of the Australian fauna. So the ANWC sought to build its egg collections instead from donations from the legion of private collectors in Australian ornithological circles.

Several valuable nucleus collections had already arrived: the E. A. D'Ombrain, J. D. Waterhouse, and Gordon Burns collections, the first received with study-skins via Dom Serventy and not donated with the Serventy-Whittell Collection to the Western Australian Museum (*cf.* Whittell 1954:205). The Waterhouse collection comprised samples of sea- and land-birds from Norfolk and Lord Howe islands, including specimens of the extinct Lord Howe Island Morepork (*Ninox novaeseelandiae albaria*) and Tasman Starling (*Aplonis fusca hulliana*), while the Burns collection focussed on northern hemisphere shore- and seabirds, with extensive collections of many species that occur in Australia only as non-breeding migrants. Towards the end of the 20th century, many of the private collectors were tiring; and the lure of donating their collections to an authorized national institution, such as the ANWC, for tax deductions under the Australian Government's Cultural Gifts Program, attracted them.

Collections had been promised, foremost among which were the Gordon B. Ragless Collection in Adelaide of over 3800 sets covering most species of Australian birds, and the R. H. Green collection of about half that size specializing on Tasmanian birds and accompanied by an extensive study-skin collection as well. Another that would have been promised, I was told, was the legendary collection of Mervyn Goddard in north-eastern New South Wales, had Goddard not "destroyed" it in a fit of depression triggered, just after the death of his son, by news of an imminent raid by the New South Wales National Parks and Wildlife Service in the early 1980s. This I heard from Goddard himself when I passed through Tenterfield one evening in early 1984. I had been courting him, he knew, over the several years since I had met him with Lester Short of the American Museum of Natural History in 1979 and, later in 1983, with Charles Sibley for whom Goddard had collected egg whites for protein electrophoretic studies in the early 1970s. There is a delicious irony in the ultimate outcome. Goddard, the old fox, had not destroyed either the core or the bulk of his superbly documented collection with its detailed, hand-written data sheets, but had hidden it away. On his death in early 2004, it of course came to light, and Ian Mason had little trouble in negotiating its transfer to the ANWC.

By 1999, with my retirement only a year away, it was time to call in the promises and set the egg collections up. The ANWC was registered as a recipient under the Cultural Gifts Program, and Mason and I travelled to Adelaide and Launceston to pack the Ragless and Green collections and bring them to Canberra. With funding support from the ANWC Foundation and a donation of cabinets from the ANWC's supplier, FGP in Adelaide, I then designed the housing of the collections using a modular tray system with protective perspex tops, and a modular range of cardboard boxing for sets of eggs of different sizes; these Wombey then measured up to fit to the trays. The ANWC Foundation had determined that the presentation of the Ragless Collection would be celebrated as a curatorial initiative for the ANWC.

Led by Mark Clayton, volunteers from the Canberra Ornithological Group and others worked overtime with me to box, lay-in, and label the collection in time for the launch; John Ragless, son of Gordon who was too incapacitated to attend, was flown in as guest of honour; and the event was broadcast on national radio, television, and in the press. Pushed by the energetic Mason, I set up arrangements to bring two more egg collections to the ANWC in ensuing months: the Ingham-Lane collection of close to 800 clutches from the Lester Ingham family at Orange, New South Wales, and the Don H. C. Seton collection of *c.* 1300 clutches from Queensland, both well prepared and accurately labelled. Altogether, the incoming collections, including the Burns collection of migrants, represented over 95% of Australia's land, freshwater, and shore birds, and a moderate proportion of seabirds. After my retirement, Mason took over management of the ANWC egg collections, bringing in more contributions to make them as comprehensive as any in Australia.

The flux in ANWC staffing continued until my retirement. Incoming Director/Curator Leo Joseph had to withdraw in late 1999 for family reasons, and it was not until early 2000 that a replacement was found in Terry Chesser of the American Museum of Natural History, through the good services of Professor Walter Bock of Columbia University. Chesser took up his appointment in October 2000. Bat expert Richards had retired in 1996, and with the dispersal of Braithwaite's group in 1998, I was able to recruit Mark Clayton to the ANWC, if only part-time. He had given signal service to the ANWC over the years, both on surveys and in contributing material from his earliest years, from as far afield as Western Australia and Tasmania.

Brian Walker retired as Chief at the end of 1999, but not before a generous gesture towards the ANWC, formally honouring it with the 1999 Chief's Team Award for Scientific Achievement and Impact. Publication of the passerine volume of the *Directory of Australian*

Birds, accession of the Swaby collection of Australasian bird voices, and launch of the Ragless egg collection were major contributing factors. In accepting the award for the ANWC, I referred to it as the ANWC's "Lazarus experience." Early in 2000, Steve Morton was appointed the new Chief and Denis Saunders resigned from the Divisional executive as officer responsible for the ANWC; Allen Kearns was installed in his stead. For the first time, the ANWC was withdrawn from other Divisional programs and placed directly under the administrative control of the Divisional executive, thereby extricating it from administrative complications and funding problems at program level. In effect, the ANWC had become its own program.

Approval was also gained to charge cabinet storage for specimens, a major budget item that the ANWC had traditionally purchased out of its own research reserves, to Divisional funds allocated for general maintenance. Funds were also found for buying and housing a modern, computer-linked stereo microscope, the principal strength of which was customised software for imaging patterns of spectral colouring in feathers, particularly ultraviolet reflectance, absorption, and fluorescence. I had been applying for such equipment for several years to bring the ANWC's facilities for comparative morphological research up to standard. My last field trips in mid 2000, relaxed with minimum collecting and maximum time for observation, completed studies on the feeding biology of Australian cockatoos with Professor Dominique Homberger of Louisiana State University and now Permanent Secretary of the International Ornithological Committee. Homberger had been working at the ANWC every sabbatical since 1988, focussing on the feeding mechanisms used by cockatoos and finding that fine differences in bill structure translated to gross differences in the techniques used to shell food and where to shell it, whether on the ground or in trees. The work has already had an impact on the systematics of Australia's black cockatoos (*Calyptorhynchus*) and Galah (*Eolophus*).

When I retired in late September 2000, the bird collections comprised some 40,000 study-skins, about 1500 spirit specimens, nearly 5000 skeletons or major parts thereof, cryo-frozen tissues of 10,000 specimens for molecular (DNA) analyses, 9500 sets of eggs secured or in the pipeline, and nearly 60,000 voices of Australasian birds, all comprehensively labelled and documented and curated to international standards. Except for Antarctic seabirds, they are the largest and most comprehensive collection of Australasian birds in Australia today. The

ANWC itself was now firmly established in CSIRO, its research succession in place, and its security watched over by its own Foundation with a Board of Governors.

If there was any one lesson to be learnt from its trials and tribulations, it is that systematics and ecology can make uneasy bed-fellows within one institution, and, without proper student-training and wise leadership, contribute to mutual disrespect for one another's research. Germinating in a CSIRO Division of Wildlife Ecology, the ANWC had been at a particular disadvantage, producing information of less immediate impact for conservation than many Divisional ecologists, competing for and taking funding, and collecting animals with warm blood in the very face of ecologists working for their protection. Nor had my single-minded "go it alone at all costs" approach always helped. The ANWC was ready prey for prejudicial judgement from many unfamiliar with not just the theory and practice of vertebrate systematics and natural history, but also its state in Australia, its material needs and longer-term conservational objectives. It was a judgement encouraged by the pejorative message in the joke: "Question: what is an example of an extinction process? Answer: Dick Schodde and the ANWC!" Similar threads of incomprehension run through the report of the 1996 review panel that the Division would have used to dissolve the ANWC; and they come through again in the current policy on scientific collecting of Birds Australia (RAOU), produced by a decision-making committee set up without an accredited systematist. Had the ANWC grown up within a heritage museum, at arm's length from wildlife ecologists, the relationship may have been different and much as it is today between museums and fauna departments in the Australian States. Perhaps this, at national level, is now the next step.

The inheritance.—From the moment I was taught as a student to collect and prepare bird specimens by the South Australian naturalist Erhard Boehm, I have believed that the only ethical justification for collecting wildlife is to advance knowledge of animals and their conservation. This ethos has been the driving force behind the collection-building program of the ANWC, from the late 1950s on; and it draws its strength from the truism that wildlife cannot be managed effectively, and its conservation prioritised properly, without knowing *what* taxa are involved and *where* they live. The ANWC envisioned by Frith, Calaby, and Hitchcock has not been a mindless collecting machine, but a planned project conceived in the public interest. Focussing on solving taxonomic and zoogeographic problems by species and region, it has gathered one of the most research-effective collections of Australian land and freshwater birds in the world. Notwithstanding its gaps, it is a collection of great heritage value as a preserved record of the Australian bird fauna; and it has become an essential base for inventorying Australia's avian resources for biodiversity conservation. Its concentration on birds has come not just from personal interest, but as much because limited staffing allowed thorough work on only one class of vertebrates and the fact that birds, due to their diversity and range of niches, are the best continent-wide indicators of biodiversity quality and quantity among Australian vertebrates.

Yet more than this, the curation of collections of all other vertebrates bequeathed to the ANWC by the ecological species studies and fauna surveys of the Frith and Calaby years—the macropodid, dingo, and water rat (*Hydromys*) study-skins and skulls, the Australo-Papuan bat and small mammal collections of some 15,000 specimens, the mammals of western Arnhem Land, an historic collection of Greater Gliders (*Petauroides volans*) from Hugh Tyndale-Biscoe, and the most comprehensive collection of rock wallabies (*Petrogale*) in existence—has also been secured properly.

Such has been the input into the ANWC; what has been its output in the first 40 years? For Australasian birds alone, the ANWC and workers associated with its collections published over 150 journal papers and refereed book chapters on their systematics, fossil history, and zoogeography. Over 60 new subspecies of Australasian birds are described in these papers and books, some of which are likely to be treated as distinct species in the future. As well, the ANWC produced eight formal regional fauna survey reports, four of which deal exclusively with Australo-Papuan birds, and 22 major consultancy reports and maps for contracted Environmental Impact Assessments and other projects for both government and the private sector. Unpublished but distributed information from the Alligator Rivers survey contributed to the case for establishing Kakadu National Park in 1979 and its subsequent World Heritage listing in 1981. The ANWC also contributed symposia dealing with the origin and evolutionary radiation of Australian birds at two International Ornithological Congresses, and participated in others. Zoogeographical information from these studies highlighted the refugial nature of the north-eastern Queensland rainforest biota, linking it with the Tumbunan biota in montane New Guinea, and was used in the nomination for placing that region on the World Heritage list in 1988.

By 2000, the ANWC had published six books covering Australia's birds: two monographs dealing with the fairy-wrens (Maluridae) and nocturnal birds, the only single-volume handbook of Australian birds, a species list of Australian vertebrates, a checklist of land non-passerines (pigeons to rollers) in volume 37.2 of the *Zoological Catalogue of Australia*, and the passerine volume of the *Directory of Australian Birds*. These are itemized in an appendix below. The species list provided state-by-state distribution and conservation status; the land non-passerine checklist established the nomenclatural base in Australia for all families treated; and the *Directory* inventoried and diagnosed all passerine taxa down to the level of regionally distinct population, the basic units of Australian avian biodiversity. The last work forms one of the taxonomic bases for conservation assessment and policy for birds for the Australian Government's Department of Environment and Heritage and the Garnett-Crowley *Action Plan for Australian Birds* (2000), as well as for the treatment of subspecies in passerine volumes of the *Handbook of Australian New Zealand and Antarctic Birds* (HANZAB 1990-2006). It is also included in the reading list for the only course in ornithology at an Australian university, Charles Sturt University.

Other practical contributions include the provision of tissues for the molecular studies of Les Christidis and others on the phylogeny and systematics of Australo-Papuan birds, as well as the sound recordings for chapters on bird voices in HANZAB and study-skins for plumage descriptions in that project. For the plumage work, Jamie Matthew was posted to the ANWC for three years (1998-2001). The ANWC collections and field program have also attracted eminent international ornithologists not just to visit but to work with them, often on sabbaticals, among them Walter J. Bock (1974), Dominique G. Homberger (1987-1988, 1992, 1996, 2000), Thomas G. Howell (1984-1998), Lester L. Short (1974, 1979), and Charles G. Sibley (1983); Joel Cracraft worked through the collections of birds-of-paradise in late 1990. Postgraduate students were also attached to the ANWC for supervision, most notably Les Christidis (1984), Janette Norman (1987), Ian Scott (1990-1991), Sonia C. Tidemann (1979-1982), and Karol Kisokau (1977-1979) from Papua New Guinea; and Christidis took a CSIRO post-doctoral fellowship at the ANWC in 1985-1987. In birds as in mammals, the core thrust in all of this production and collaboration was improvement of information on the diversity of Australasia's wildlife and its distinctiveness. The more significant publications are listed in the appendix below.

In ornithological science itself, the ANWC had also made impacts. Its reinterpretation of bird and mammal faunal relationships between the Australian and montane New Guinean rainforests in terms of vicariance and antiquity (Schodde and Calaby 1972, Schodde and Faith 1991) laid the foundation for a paradigm shift in understanding the origin and evolutionary radiation of Australia's core land-bird fauna out of Gondwana (Schodde 1991). The same ideas, too, provided a new approach for interpreting historic adaptation in the Australian bird fauna from ancestral Gondwanan rainforest sources into the Australian sclerophyllous biota and, ultimately, Australia's arid zone (Schodde 1982).

Yet the potential for the ANWC to deliver such knowledge has still barely been realised. It is a library of information on Australasia's fauna, but with a difference: unlike books in conventional libraries, much of the information held by the ANWC has still to be discovered.

ACKNOWLEDGEMENTS

I am most grateful to Dan Walton and Walter Bock for their considered and insightful criticism of the manuscript, and to Jo Savill, CSIRO Sustainable Ecosystems, for preparation of the illustrations for publication. Margaret Cawsey and John Wombey of the Australian National Wildlife Collection assisted in providing information on numbers of specimens in the ANWC. All photographs are courtesy of CSIRO, Australia.

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7

The History of Threatened Birds in Australia and its Offshore Islands

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ABSTRACT.—-Of the 640 species of birds present in Australia in 1750, 1.4% are extinct, 6.7% are threatened and 4.8% are near threatened. This is lower than in many other parts of the world, which is partly explained by the environmental history within which Australian birds evolved, initially without people as the continent drifted north and away from other Gondwanan fragments. The trend in the status of threatened species since then has been exponential, based on patterns of environmental change and historical records that allowed estimation of the status of all Australian species at 50-year intervals since 1750. Island faunas have been the worst affected, but the mainland fauna is under increasing pressure, even if intensive conservation management has prevented some extinctions. We predict that by 2050 nearly 20% of Australian species will be at least near threatened, even if existing conservation management continues to be applied. This is because, although most threatened species have survived long enough to benefit from recent conservation initiatives, they now face rapid climate change and the residual effects of habitat fragmentation and degradation.

Extinction and rarity are natural evolutionary phenomena. However, they are also functions of historical process. This is an account of how biological history and human history have interacted to produce the patterns of rarity and threat currently found in Australia and its islands.

Only one bird species, the Paradise Parrot (*Psephotus pulcherrimus*), is acknowledged to have become extinct on the Australian mainland since 1750. Although others are or have been perilously close, the

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rate of bird extinction is lower than in many parts of the world of equivalent area. But on the six offshore islands administered by Australia, bird species have disappeared, and are disappearing, at a rate commensurate with that of island birds elsewhere round the world in the last few centuries (Stattersfield and Capper 2000). Here, in order to better understand extinction and its drivers, we examine the evolutionary history of Australian birds, the history of the environment in which they evolved, and the history of the human societies with which those birds attempted to coexist. We use this information to develop predictions for the future of Australian birds.

We consider the history of threatened birds in Australia over three broad periods: (1) the prehuman history of the continent from when it first separated from Gondwana, (2) its human history from the arrival of Indigenous people through to settlement by Europeans in 1788, and (3) the period since that time. For each of the periods, a description of environmental trends is provided for the mainland and the oceanic islands for which Australia has responsibility (Norfolk, Lord Howe, Christmas, Cocos [Keeling], Macquarie and Heard), a discussion of the species for which status has changed and, where possible, an account of actions taken to arrest trends in decline.

The first two periods, which rely heavily on palaeontology, provide an environmental context for avian evolution in Australia. The period since 1750 has been divided into 50-year periods. For each 50-year interval we attempted to assess the status of each of the 640 bird species occurring regularly in Australia and its islands. Taxonomic nomenclature for species and genera follow Christidis and Boles (1994), except for some hawk-owls and grasswrens where we followed Norman et al. (1998) and Christidis (1999). Status was determined using the International Union for the Conservation of Nature and Natural Resources (IUCN) guidelines (IUCN 2001). Historical classifications were based on estimates of each species' likely population size and distribution, and changes in them. In the absence of such information, a species' status was based on an expected response to a known chronology of environmental and social change. The status we have allocated to Australian birds in 2000 follows that of Garnett and Crowley (2000) except where revised by BirdLife International on the basis of more recent information (BirdLife International 2004, 2005c, 2006). Dates of extinction are based primarily on date of last sighting recorded in Garnett and Crowley (2000).

The resulting narrative is thus a hybrid history of birds and the environment, economic development, and social change, which aims to build on the accounts of Recher (1999) and others and give greater definition to the trajectory of the Australian avifauna into the future.

Prehuman evolution.—When Australia progressively separated from the aggregated southern continent of Gondwana 90-55 mya (Stevens 1990), it carried north ancestral stock of many Australian bird families, including ratites, megapodes, and parrots, as well as the passerines that dominate global bird species diversity (Christidis 1990). The Australo-Papuan plate then drifted north in oceanic isolation before the ongoing collision with the Asian plate began about 40 mya, throwing up the New Guinea cordillera and greatly reducing the maritime gap between the avifaunas of Australia and Asia. Importantly for modern conservation, Australia gradually dried out through the Tertiary. These changes resulted in the evolution of three regional bird faunas, a Bassian fauna of Australian endemics, a tropical Torresian fauna largely shared with New Guinea, and an arid fauna derived from both. Finer-scale division of the Australian avifauna occurred during the Pleistocene as a result of repeated ice ages (Schodde and Faith 1990), which set the patterns of endemism underlying much species rarity today. Relictual Tertiary vegetation became restricted: temperate forests persisted in south-eastern and south-western Australia, rainforest was associated with hills along the eastern seaboard and in moist pockets across the tropics. The extensive plains of the arid zone were patchily relieved by rocky refugial hills. The relatively small areas of once extensive forests also encompass most permanent wetlands and perennial rivers. Water availability elsewhere became unpredictable; there has been little speciation among waterbird species because most cope with the water emphemerality by moving long distances. In the savannas, grasslands, shrublands, and woodlands that cover the rest of the continent, the habitats in which birds evolved remained relatively continuous.

The availability of water was the lowest at any time in at least the last 20 my about 18,000 years ago (Bowler et al. 1976). Many of the forests and woodlands in the south-east were replaced with grasslands (Singh and Geissler 1985) and the rainforests contracted to refugia in river valleys and on mountain tops (Hilbert et al. 2001). Subsequently the climate ameliorated until, 10,000 years ago, it became similar to today. The sea level took longer to respond to the warmer conditions, but eventually the ice melted and, for the last 6000 years, sea level has also changed little. The rise in sea level from 7000 to 6000 years ago cut off the continental islands from the Australian mainland. These included Tasmania, King, and Kangaroo islands that had endemic species when Europeans first arrived. However, the extent of endemism in at least Tasmania, where 12 species do not breed elsewhere, suggests that conditions on the land bridge that existed at low sea levels were too bleak for much genetic interchange.

The post-Pleistocene amelioration of conditions enabled expansion of rainforests that may be continuing today (Hopkins et al. 1993), with the spread of eucalypt woodlands across the south-west, south-east, and Tasmania, replacing grasslands and heathlands on both the western slopes of the Great Dividing Range and in the uplands. Nevertheless, the general biogeographic patterns developed during the Pleistocene underlie the distribution of the seven great refugia of mesic Australian birds. These refugia are Cape York Peninsula, the Wet Tropics, the eastern seaboard, mallee, Tasmania, and south- and north-west Australia. These areas each contain more than one bird species with a range of less than 50,000 km^2 (Stattersfield et al. 1998). An additional seven refugia (South Australian and Simpson-Strezlecki deserts, Bulloo-Diamantina drainages, Gulf fall, Clarke and Selwyn ranges, and the eastern and north-western mangroves), mostly in the arid zone, each contain just one species with a restricted distribution.

The avifaunas of the islands were derived from species that originally came from elsewhere, with at least 18 land-bird species endemic to Australian oceanic islands and derived from individuals whose antecedents must have crossed oceanic barriers. However, even islands uninhabited by humans have a relatively high rate of species turnover compared to the mainland; at least three species that once nested on Lord Howe Island, as evidenced by the subfossil record, were absent when Europeans arrived in 1788 (Meredith 1991).

The number of species that became extinct during Australia's long passage north and subsequent drying will never be known. The fossil record is relatively sparse and mostly recent, but it is safe to assume that the fundamental shift from a vast, warm, moist, Tertiary forest to a largely arid continent with unreliable rainfall must have reduced Australian bird diversity substantially. Of the 149 species in 116 genera at the 179 Pleistocene fossil sites containing avian material listed by Baird (1991a), 21 species (14.3%) and 12 genera (10.1%) are extinct.

Most, including five species of flamingo or related genera, occurred in deposits preceeding the first human arrivals. The cold, dry, ice age of 18,000 years ago was likely to have been particularly telling for forest and wetland species. The modern mesic vegetation probably contains a slightly less diverse fauna than before the ice ages regardless of human intervention. Even species with restricted ranges probably passed through a bottleneck at the time when the area of habitat available to mesic birds was much smaller.

Pre-European history.—Humans arrived in Australia from southeast Asia during the Pleistocene at least 60 thousand years ago. Given climatic vicissitudes, the role of humans in causing extinctions during this period has been much-debated. Many species disappeared during the late Pleistocene and thus co-existed for a while with humans. Miller et al. (1999) suggest that extinction of the large scansorial dromornithid (*Genyornis*) was the result of habitat change caused by Aboriginal burning and the evidence that Maori rapidly hunted moa to extinction in New Zealand (Trotter and McCulloch 1984) implies that hunting may also have contributed to extinctions in Australia. Kangaroos and wallabies were much less likely to persist on islands that could be reached from the mainland than on those that were inaccessible (Abbott 2002), even if this is not true of all mammals (Burbidge and Manly 2002). The absence of people from King and Kangaroo islands when Europeans arrived may explain the persistence of endemic emu species there.

A number of extant species may have met the modern IUCN definitions of being threatened during the Pleistocene, even if their populations later stabilised. About 5000 years ago Dingoes (*Canis lupus dingo*), wild dogs, arrived in Australia, presumably as human companions (Savolainen et al. 2004). This, and a sudden increase in the population of people (Johnson and Wroe 2003), coincided with the rapid decline and eventual disappearance of the flightless Tasmanian Native-hen (*Tribonyx mortierii*) from the mainland (Baird 1991b). The disappearance of the currently endangered Eastern Bristlebird (*Dasyornis brachypterus*) and the vulnerable Rufous Scrub-bird (*Atrichornis rufescens*) from western Victoria (Baird 1991a) suggests their current vulnerability to fire long pre-dated European arrival. Nevertheless, despite the disappearance of species during the late Pleistocene, all mainland or Tasmanian species known from fossil and subfossil deposits from the Holocene are still extant (Baird 1991a). For the purposes of this paper, therefore, we assume that when Captain Arthur Phillip sailed into Port Jackson to establish the first European settlement in January 1788, no Australian mainland or Tasmanian species was declining rapidly, and that all species that had been sensitive to environmental changes brought about by Aboriginal land management had already disappeared. We have assessed that just two species are likely to have had the status of near threatened at that time, as they do today. These are the Letter-winged Kite (*Elanus scriptus*), because of its rarity and the severity of its population fluctuations, and the sparsely distributed Grey Falcon (*Falco hypoleucos*), both of which may sometimes have had populations approaching 1000 individuals.

On most islands with range-restricted species (Norfolk, King, Kangaroo, and Albatross islands), people had at least visited before Europeans arrived. For Lord Howe and Christmas islands, the first known human visits were by Europeans during the 18th century. Off Tasmania, landings on Pedra Branca and the Mewstone are even more recent. On Norfolk Island middens were found to contain bones of an endemic snipe *Coenocorypha* sp., an endemic rail *Gallirallus* sp., five petrel species, and a raptor *Accipiter* sp., none of which was recorded as present on the island when Europeans arrived. These species are assumed to have been hunted to extinction before the earlier settlement of humans themselves either left or died out (Meredith 1991). The Polynesian Rat (*Rattus exulans*), a species commensal with Polynesian travellers of the Pacific, outlasted its introducers and may have depressed populations of some species subsequently encountered when Europeans arrived (Holdaway and Anderson 1998). The absence of people from King and Kangaroo islands when Europeans arrived may explain the persistence of the endemic emu species there. Visits to Albatross Island had ceased long before the first sealers pulled ashore to kill the fauna there.

Given this history, we define all but one of the 22 species endemic to islands, the Shy Albatross (*Thalassarche cauta*) on islands off Tasmania, as vulnerable at the time of first settlement as they occurred at single small sites. The populations of Lord Howe Woodhen (*Gallirallus sylvestris*) and White Gallinule (*Porphyrio albus*) of Lord Howe Island we think were probably small enough to be endangered (i.e., <250 individuals) before human arrival. Offshore islands also supported small breeding populations of 34 seabird species that also occurred elsewhere. While globally of least concern, the Australian populations or the breeding ranges of these species would have been small enough for them to be considered threatened at a national level. The status of 22 of these has not changed to today.

HISTORY SINCE THE ARRIVAL OF EUROPEANS

While the history of European interactions with Australian birds began in the 17th century (Calaby 1999), it was only in the late 18th century that Europeans started to have an impact sufficient to threaten entire species. Over the subsequent 250 years the impact of Europeans on the Australian environment increased exponentially (Figure 1).

1750-1800 (Table 1).—Europeans and their settlements in the 18th century were confined to a few sites between Brisbane and Sydney on

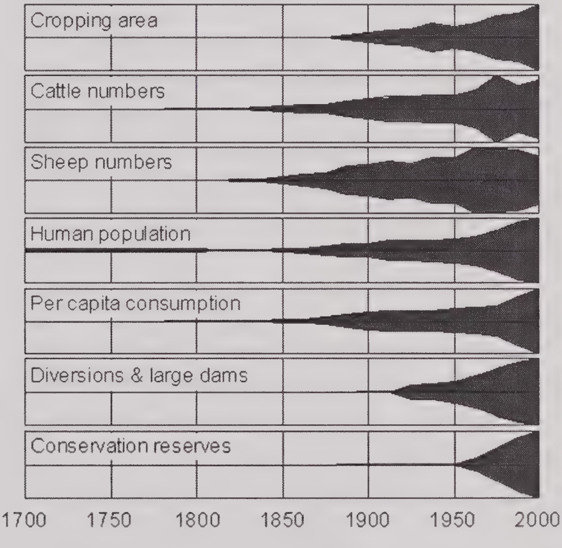

Figure 1. Change in a selection of Australian environmental indicators. Each measure is scaled to a proportion of the maximum value. Data for most measures are presented at 10-15-year intervals. Diversions indicate the volume of water diverted from the Murray Darling system (Australian Bureau of Statistics 1999, 2001a,b,c, Archer et al. 1999, Department of Environment and Heritage 2000).

TABLE 1. Change in status of Australian species postulated for 1750-1800. All taxa not listed are thought to have been Least Concern throughout.

Status 1750	Status 1800	Name	Proposed reasons
Endangered	Extinct	White Gallinule *Porphyrio albus*	Hunting
Vulnerable	Critical	Norfolk Island Ground-Dove *Gallicolumba norfolciensis*	Hunting
		King Island Emu *Dromaius ater*	Hunting, deliberately-lit fires in rarely burnt habitat
		Kangaroo Island Emu *Dromaius baudinianus*	Hunting, deliberately-lit fires in rarely burnt habitat
Vulnerable	Endangered	Providence Petrel *Pterodroma solandri*	Hunting
		Norfolk Island Green Parrot *Cyanoramphus cookii*	Hunting, habitat clearance for timber
		Norfolk Island Kaka *Nestor productus*	Hunting, habitat clearance for timber

Species of conservation concern with status unchanged during period: **Endangered:** Lord Howe Woodhen *Tricholimnas sylvestris*, **Vulnerable:** Royal Penguin *Eudyptes schlegeli*, Abbott's Booby *Papasula abbotti*, Christmas Island Frigatebird *Fregata andrewsi*, Christmas Island Imperial-Pigeon *Ducula whartoni*, Christmas Island Hawk-Owl *Ninox natalis*, Norfolk Island Gerygone *Gerygone modesta*, Lord Howe Gerygone *Gerygone insularis*, Christmas Island White-eye *Zosterops natalis*, Robust White-eye *Zosterops strenuus*, Slender-billed White-eye *Zosterops tenuirostris*, White-chested White-eye *Zosterops albogularis*, Tasman Starling *Aplonis fusca*; **Near Threatened:** Shy Albatross *Thalassarche cauta*, Letter-winged Kite *Elanus scriptus*, Grey Falcon *Falco hypoleucos*.

the east coast of mainland Australia, and at Port Arthur in Tasmania. Almost immediately upon arrival Europeans set in motion processes that are still having consequences. Smallpox, measles, and other diseases first affected Indigenous people near Sydney in 1789, then spread rapidly westwards, well ahead of European explorers and settlers (Crosby 1986). The impact of smallpox the length of the Murray River and into Victoria is well-documented, but the impacts of these diseases elsewhere may also have been substantial and simply not recorded. The results of this and ensuing epidemics was a greatly diminished capacity of Aboriginal populations to manage lands in a traditional manner, particularly using fire. Research in northern Australia suggests the cessation of Indigenous land management would have had effects on bird populations over at least the subsequent century (Franklin 1999). Europeans also brought animals with them that became feral such as

European Cattle (*Bos taurus*), Goats (*Capra hircus*), Domestic Cats (*Felis sylvestris catus*), and Domestic Pigs (*Sus scrofa*), although it would be many years before they had an ecological impact (Abbott 2002).

Unlike on the mainland, the effects of European arrival on islands were swift and substantial. The people in the penal settlement established on Norfolk Island in the same year as Port Jackson, 1788, christened the Providence Petrel (*Pterodroma solandri*) because it was the only source of food. Initially superabundant, the species was the subject of Australia's first attempt at threatened species management when Philip Parker King, the island's commandant, ordered that the harvest be rationed (Bonyhardy 2000). By then, too many had been slaughtered; the Norfolk Island population disappeared by about 1800. Similarly, the Norfolk Island Ground-Dove (*Gallicolumba norfolciensis*) is known only from subfossil bones and a single painting (Hindwood 1965), and the White Gallinule was seen only on the first two visits to Lord Howe Island in 1788 (McAllan et al. 2004); both species probably survived only a few years of slaughter. Some of the larger terrestrial Norfolk Island species, including both endemic parrot species, undoubtedly suffered from hunting, loss of habitat and predation by introduced pigs, cats, and dogs (Bonyhardy 2000), and we think they were endangered at this time. The temporary occupation of many southern islands by sealers and whalers initiated threatening processes that were to play out over the next few decades; by the end of the 18th century we think both island emus were critically endangered.

1800-1850 (Table 2).—In the first half of the 19th century, towns were established in all current states, although colonisation in the deserts and north of the tropics was constrained, tentative, and often temporary. In the southern zone of settlement, continued management of land by surviving Aboriginal people largely ceased. From 1829, Tasmanian Aborigines were moved to Flinders Island. From 1839, Victorian Aborigines were rounded-up into missions. By that stage sheep grazing in western Victoria had annihilated the most important source of carbohydrate for indigenous people, Murnong (*Microseris lanceolata*) (Gott 1983), a perennial composite with exceptional tuberous roots. Disruption to Aboriginal communities resulted in a cessation of fire management (Jones 1969). Ensuing intense bush fires led to an anti-fire mentality; in Western Australia legislation was introduced pro-

TABLE 2. Change in status of Australian species postulated for 1800-1850. All taxa not listed are thought to have been Least Concern throughout.

Status 1800	Status 1850	Name	Proposed Reasons
Critical	Extinct	King Island Emu	Hunting, deliberately-lit fires in rarely burnt habitat
		Kangaroo Island Emu	Hunting, deliberately-lit fires in rarely burnt habitat
		Norfolk Island Ground-Dove	Hunting
Endangered	Critical	Lord Howe Woodhen	Hunting, predation by introduced pigs
		Norfolk Island Kaka	Hunting, habitat clearance for timber
Near Threatened	Vulnerable	Shy Albatross	Hunting
Least Concern	Near Threatened	Noisy Scrub-bird *Atrichornis clamosus*	Increased frequency and area burnt by deliberately-lit fires
Least Concern	Vulnerable	Long-billed Corella *Cacatua tenuirostris*	Overgrazing by sheep removed traditional food

Extinct species, or species of conservation concern with status unchanged during period: **Extinct:** White Gallinule; **Endangered:** Providence Petrel, Norfolk Island Green Parrot; **Vulnerable:** Royal Penguin, Abbott's Booby, Christmas Island Frigatebird, Christmas Island Imperial-Pigeon, Christmas Island Hawk-Owl, Norfolk Island Gerygone, Lord Howe Gerygone, Christmas Island White-eye, Robust White-eye, Slender-billed White-eye, White-chested White-eye, Tasman Starling; **Near Threatened:** Letter-winged Kite, Grey Falcon.

hibiting the lighting of fires in spring or summer (Bolton 1981). A lack of fire meant that some areas of grassy woodland rapidly became dense forest (Barr and Cary 1992), reducing their grazing potential and altering long-established biogeographic patterns. Pastoralism and some agriculture spread rapidly through areas of south-eastern and south-western Australia receiving at least 600 mm average annual rainfall, as well as along the Murray River corridor, through the central Tasmanian lowlands, and along the coastal plain north of Brisbane. Open grasslands and grassy woodlands were exploited first, but clearance of more heavily forested areas had begun (Bolton 1981). Sealing and whaling continued around the south coast and wild populations of Horses (*Equus caballus*), Water Buffalo (*Bubalus bubalis*), pigs and Honey Bees (*Apis mellifera*) were becoming established on the mainland. In Tasmania, European Rabbits (*Oryctolagus cuniculus*) were introduced in 1829, 25 years before they were introduced on the mainland (Bolton 1981).

While the spread of European land use was starting to have impacts on parts of the continent, the status of most birds on the mainland probably changed little. The change in fire regime probably had the greatest influence. In the south-west, the range of the fire-sensitive heath and swamp species between Perth and Albany, such as Noisy Scrub-bird (*Atrichornis clamosus*), may have declined at a rate that would have made them near threatened. In south-east Australia, the Long-billed Corella (*Cacatua tenvirostris*) is likely to have become vulnerable as a result of grazing, after losing the tubers of Murnong that were its staple diet.

On the islands, the attrition of the previous 12 years continued unabated. Like the Tasmanian subspecies of Emu (*Dromaius novaehollandiae diemensis*), the King Island and Kangaroo Island emus (*D. ater* and *D. baudinianus*) were either hunted to extinction or had their habitat burnt to an extent that they could not survive. On Albatross Island, whalers and sealers began boiling down hundreds of nesting Shy Albatross at a site where piles of bones still remain. A lack of records prevents an assessment of trends on Lord Howe Island, but declines in Lord Howe Woodhen are likely to have started following the introduction of cats in the 1840s (McAllan et al. 2004), as well as clearance of the lowlands for agriculture. On Norfolk Island, no bird became extinct, but continued intensification of land use reduced the population size of most species. On Macquarie Island, the sealers killed penguins, to the extent that we think that the largest of them, the King Penguin (*Aptenodytes patagonicus*) was probably globally near threatened at this time. Cats, Black Rats (*Rattus rattus*), and Wekas (*Gallirallus australis*), all of which preyed on small seabirds, were also introduced.

1850-1900 (Table 3).—The discovery of gold in Australia in 1849 and rapid expansion of Sheep (*Ovis aries*) grazing drove a rapid rise in the population of both immigrant people and immigrant animals. For the first time land clearing and habitat fragmentation became a genuine threatening process for some populations of mainland birds, particularly in southern and eastern Australia, although clearing was done by hand and horse and its effects sometimes took a hundred years to be manifest. Early settlers identified good soil by the vigour of its timber and cleared it for pasture and agriculture. This, combined with an ener-

TABLE 3. Change in status of Australian species postulated for 1850-1900. All taxa not listed are thought to have been Least Concern throughout.

Status 1850	Status 1900	Name	Proposed Reasons
Critical	Extinct	Norfolk Island Kaka	Hunting, lack of nesting habitat
Endangered	Vulnerable	Providence Petrel	Decline halted, one stable population on Lord Howe I.
		Norfolk Island Green Parrot	Hunting ceased, population probably stable in reduced habitat
Vulnerable	Near Threatened	Long-billed Corella	Adapted to new environmental conditions, scarce but increasing
Near Threatened	Vulnerable	Noisy Scrub-bird	Increased frequency and area burnt by deliberately-lit fires
Least Concern	Critical	Night Parrot *Pezoporus occidentalis*	Spread of introduced cats following spread of rabbits
Least Concern	Endangered	Paradise Parrot *Psephotus pulcherrimus*	Overgrazing by sheep, changed fire regime
		Eastern Bristlebird *Dasyornis brachypterus*	Increased area and frequency of deliberately-lit fires, habitat clearance for housing
Least Concern	Vulnerable	Turquoise Parrot *Neophema pulchella*	Overgrazing by sheep, habitat clearance for agriculture
		Western Bristlebird *Dasyornis longirostris*	Increased frequency and area burnt by deliberately-lit fires
Least Concern	Near Threatened	Magpie Goose *Anseranas semipalmata*	Hunting of southern populations, habitat drainage
		King Penguin *Aptenodytes patagonicus*	Hunting on sub-Antarctic islands
		Australasian Bittern *Botaurus poiciloptilus*	Habitat drainage
		Black-breasted Button-quail *Turnix melanogaster*	Habitat clearance for agriculture
		Plains-wanderer *Pedionomus torquatus*	Cultivation of habitat and overgrazing by sheep
		Swift Parrot *Lathamus discolor*	Habitat clearance for agriculture

Orange-bellied Parrot *Neophema chrysogaster*	Changed fire regime in breeding habitat, cultivation of habitat, and overgrazing by sheep in non-breeding habitat
Albert's Lyrebird *Menura alberti*	Habitat clearance for agriculture, increased frequency and area burnt by deliberately lit fires
Rufous Scrub-bird *Atrichornis rufescens*	Habitat clearance for agriculture, increased frequency and area burnt by deliberately lit fires
Thick-billed Grasswren *Amytornis textilis*	Excessive sheep and rabbit grazing across chenopod shrublands

Extinct species, or species of conservation concern with status unchanged during period: **Extinct:** King Island Emu, Kangaroo Island Emu, White Gallinule, Norfolk Island Ground-Dove; **Critical:** Lord Howe Woodhen; **Vulnerable:** Royal Penguin, Shy Albatross, Abbott's Booby, Christmas Island Frigatebird, Christmas Island Imperial-Pigeon, Christmas Island Hawk-Owl, Norfolk Island Gerygone, Lord Howe Gerygone, Christmas Island White-eye, Robust White-eye, Slender-billed White-eye, White-chested White-eye, Tasman Starling; **Near Threatened:** Letter-winged Kite, Grey Falcon.

getic timber industry supplying the gold mines and export markets, removed forests at such a rate that Royal Commissions into forest management were held in both Victoria and New South Wales before the century's end. In South Australia, native forests were already being replaced by plantations of the exotic Monterey Pine (*Pinus radiata*; Carron 1985). It was during this period that the Big Scrub of northern New South Wales and many of the lowland forests of south-east Queensland were cleared, and clearing began of the rainforests of north Queensland (Frith 1973). Major swamps in south-eastern Australia were drained and/or cleared (Wheelwright 1868), others became salty within a decade of the woodlands in their catchments being cleared (Barr and Cary 1992). The effect of pastoralism was on a much broader scale. In New South Wales, the grasslands and grassy woodlands west of the Great Dividing Range were so overgrazed that another Royal Commission was held to find out why. The huge build-up in stocking densities was followed by a major drought in the 1890s, the effects of which are still apparent in the Western Division of New South Wales more than a hundred years later (Griffiths 2001). Over this 50-year period sheep and cattle enterprises spread across all but the most arid parts of the inland and the more isolated parts of the north. Grazing by sheep and cattle led to rapid deterioration of native pastures in New South Wales and Victoria, with the loss of saltbush and native grasses, the invasion of exotic weeds, and massive rill erosion (Powell 1976, Bolton 1981). Even in the north, open woodlands changed to dense thickets of woody vegetation within a few years of overgrazing by cattle (Roberts 2005). The push of sheep and cattle stations into the extensive Australian rangelands also meant that the traditional patchy burning regime that had persisted until then was replaced, in most places, with one thought to favour pastoralism. Aboriginal people were forced to adapt to living with the pastoral industry (May 1994, Crowley and Garnett 2000). In southern Australia, traditional Aboriginal fire regimes had effectively been lost and replaced by a system of no burns interspersed with wildfires, or repeated use of fire to clear fire-sensitive habitats like heaths, swamps, and casuarina forests. The rapid increase in individual wealth also allowed more decorative Europeanization of the landscape. Ornamental gardens were filled with exotic species, many of which escaped to become environmental weeds. Acclimatisation societies were enthusiastically supported, particularly in the 1850s and 1860s, successfully introducing 17 new bird species, including all those that have since moved beyond the cities. Following their earlier introductions to Tasmania and near Sydney, New South Wales, rabbits were successfully introduced in Victoria in 1859 and were in pest proportions in all southern states by the end of the century (Bolton 1981), although there were some people who thought them beneficial (Littler 1902). Red Fox (*Vulpes vulpes*) and Brown Trout (*Salmo trutta*) were introduced and well-established by the end of this period. Plagues of House Mice (*Mus musculus*) threatened grain crops (Rolls 1969). Horses, cattle, Dromedary Camels (*Camelus dromedarius*), and Donkeys (*Equus asinus*) established feral populations and the first of nearly 5000 exotic species of grass and legume species were introduced to “improve” pastures (Cook and Dias 2006). Finally, direct exploitation was sometimes excessive, especially where native fauna was exploited to meet the appetites of gold miners.

It was during this period that the first extinctions of small mammals were recorded in the drier parts of the continent (Frith 1973, Morton 1993, Maxwell et al. 1996). For birds there were no known extinctions, but declines had started. The once vast Victorian populations of Magpie Goose (*Anseranas semipalmata*) and Australian

Bustard (*Ardeotis australis*) were all but eliminated by habitat loss, hunting, and poisoning (Frith 1967), although the geese persisted on the Murray until the 1902 drought (Hall 1909). The Cape Barren Goose (*Cereopsis novaehollandiae*) had also declined on the mainland (Austin 1908). Salinisation and drainage of wetlands is also likely to have started the decline of the Australasian Bittern (*Botaurus poicilocephalus*), while agriculture in Victoria and South Australia and intensive grazing of rangelands, particularly in western New South Wales, started the decline of the Plains-wanderer (*Pedionomus torquatus*) and Thick-billed Grasswren (*Amytornis textilis*) (NSW National Parks and Wildlife Service 2002), with many other species declining at a local level (Smith and Smith 1994). Further north, the Paradise Parrot and Turquoise Parrot (*Neophema pulchella*) all but disappeared from New South Wales and south-east Queensland (Campbell 1915), probably as a result of changes associated with grazing by sheep. The Long-billed Corella was by now a rare bird, though numbers may have been recovering (Hill 1903). Closer to the coast the loss of rainforest and associated habitats greatly reduced the populations of Black-breasted Button-quail (*Turnix melanogaster*), Albert's Lyrebird (*Menura alberti*), Rufous Scrub-bird and, especially, Eastern Bristlebird. In the south-west, active clearance was largely in the future, but increased burning would have had a severe effect on sensitive species. Fires started at this time by trains carting timber from the damp gullies of the Darling Ranges probably eliminated Noisy Scrub-birds from much of their range (A. H. Burbidge pers. comm.), and burning of the heaths was probably starting to affect the Western Bristlebird (*Dasyornis longirostris*) (A. H. Burbidge pers. comm.) and Western Whipbird (*Psophodes nigrogularis*) (Milligan 1904). In Tasmania, agricultural development of the fertile central valley started to affect populations of Swift Parrot (*Lathamus discolor*) and Forty-spotted Pardalote (*Pardalotus quadragintus*). The loss of fire management in south-west Tasmania and intensification of land-use on the mainland may also have started the decline of Orange-bellied Parrot (*Neophema chrysogaster*). Finally, the 1890s were the last years in which multiple records were obtained of the Night Parrot (*Pezoporus occidentalis*). Its sudden rarity coincides with the spread of the feral cat into arid Australia (Abbott 2002), although there may be other reasons for its scarcity.

On the islands the attrition continued. By the end of the 19th century King Island had been all but cleared of forest and the Shy Albatross colony on Albatross Island reduced to a few small pockets of breeding birds, although hunting there had all but ended (Armstrong 1910). On Norfolk Island, the endemic Norfolk Island Kaka (*Nestor productus*) and the only Australian population of New Zealand Pigeon (*Hemiphaga novaezelandiae*) finally succumbed to hunting and habitat destruction while Lord Howe Island and Macquarie Island lost two subspecies each, including the only Australian populations of Red-crowned Parakeet (*Cyanoramphus novaeseelandiae*) and White-throated Pigeon (*Columba vitiensis*) (Hamilton 1894). Of the oceanic islands only Christmas Island was effectively unchanged over this period, but on one of two visits to the island in the 19th century, phosphate was discovered, shaping that island's trajectory.

The increased wealth arising from the environmental destruction also allowed people to look beyond personal survival and make the first real attempts at conservation. This took two forms—land preservation and wildlife protection. Australia's first national park, Royal National Park, was gazetted in New South Wales in 1879 to protect native vegetation in close proximity to the main urban centre, and Victoria, South Australia, and Western Australia declared similar parks by the end of the century (Bolton 1981). Early concern about over-hunting (e.g., Wheelwright 1868, Littler 1901) resulted in legislation to protect native birds. First introduced in Tasmania in 1860, wildlife protection laws were passed in Victoria and New South Wales soon afterwards (Bolton 1981) and were in every state by the end of the century (Campbell 1903). Neither designation of parks nor legislation had any immediate effect on the threatened status of birds, but they represented a change of attitude that did.

1900-1950 (Table 4).—The first 50 years of the 20th Century began with a particularly severe drought in eastern Australia and included two world wars, the Great Depression, and the introduction of mechanised agriculture. The world wars were important because both were followed by soldier settlement schemes that, in turn, resulted in major clearing in the Murray Mallee of South Australia and Victoria and, to a lesser extent, south-west Western Australia (Barr and Cary 1992). Many blocks of land were too small to be viable, so they were often overstocked and degraded before abandonment or consolidation. Irrigation also began on a large scale, principally around Mildura, resulting in seasonal wetlands either being drained or converted to permanent wet-

TABLE 4. Change in status of Australian species postulated for 1900-1950. All taxa not listed are thought to have been Least Concern throughout.

Status 1900	Status 1950	Name	Proposed reasons
Endangered	Extinct	Paradise Parrot	Overgrazing by sheep, changed fire regime, invasion of habitat by prickly pear
Vulnerable	Extinct	Lord Howe Gerygone	Predation by introduced rats
		Robust White-eye	Predation by introduced rats
		Tasman Starling	Predation by introduced rats
Vulnerable	Critical	Noisy Scrub-bird	Increased frequency and area burnt by deliberately-lit fires
Vulnerable	Endangered	Norfolk Island Green Parrot	Predation by introduced rats
		Western Bristlebird	Increased frequency and area burnt by deliberately-lit fires
		White-chested White-eye	Predation by introduced rats
Vulnerable	Near Threatened	Shy Albatross	Hunting ceased and population starting to recover
Near Threatened	Vulnerable	Australasian Bittern	Habitat drainage
		Black-breasted Button-quail	Habitat clearance for agriculture
		Plains-wanderer	Habitat clearance for agriculture, overgrazing by sheep
		Swift Parrot	Habitat clearance for agriculture
		Orange-bellied Parrot	Changed fire regime in breeding habitat, cultivation of habitat and overgrazing by sheep in non-breeding habitat
		Albert's Lyrebird	Habitat clearance for agriculture
		Thick-billed Grasswren	Intense grazing continuing with demonstrable decline in habitat condition across former range
Near Threatened	Least Concern	Magpie Goose	Hunting largely ceased and population in north stable
		King Penguin	Hunting ceased and population increasing

Least Concern	Endangered	Buff-breasted Button-quail *Turnix olivii*	Overgrazing by cattle, changed fire regime, shrub invasion of grassland
Least Concern	Vulnerable	Golden-shouldered Parrot *Psephotus chrysopterygius*	Overgrazing by cattle, changed fire regime, shrub invasion of grassland
		Mallee Emu-wren *Stipiturus mallee*	Habitat clearance for agriculture, increased frequency and area burnt by deliberately lit fires
		Forty-spotted Pardalote *Pardalotus quadragintus*	Habitat clearance for agriculture, invasion of habitat by Noisy Miner *Manorina melanocephala*
		Regent Honeyeater *Xanthomyza phrygia*	Habitat clearance for agriculture
		Black-eared Miner *Manorina melanotis*	Habitat clearance for agriculture, invasion of habitat by Yellow-throated Miner *Manorina flavigula*
Least Concern	Near Threatened	Malleefowl *Leipoa ocellata*	Habitat clearance for agriculture
		Red Goshawk *Erythrotriorchis radiatus*	Habitat clearance for agriculture
		Australian Bustard *Ardeotis australis*	Hunting, predation by introduced foxes
		Chestnut-backed Button-quail *Turnix castanota*	Changed fire regime, Overgrazing by cattle
		Superb Parrot *Polytelis swainsonii*	Habitat clearance for agriculture
		Princess Parrot *Polytelis alexandrae*	Overgrazing by sheep
		Speckled Warbler *Chthonicola sagittata*	Habitat clearance for agriculture
		Chestnut-breasted Whiteface *Aphelocephala pectoralis*	Overgrazing by sheep
		Painted Honeyeater *Grantiella picta*	Habitat clearance for agriculture
		Red-lored Whistler *Pachycephala rufogularis*	Habitat clearance for agriculture
		Diamond Firetail *Stagonopleura guttata*	Habitat clearance for agriculture

Extinct species, or species of conservation concern with status unchanged during period: **Extinct**: King Island Emu, Kangaroo Island Emu, White Gallinule, Norfolk Island Ground-Dove, Norfolk Island Kaka; **Critical**: Lord Howe Woodhen, Night Parrot; **Endangered**: Eastern Bristlebird: **Vulnerable**: Royal Penguin, Providence Petrel, Abbott's Booby, Christmas Island Frigatebird, Christmas Island Imperial-Pigeon, Turquoise Parrot, Christmas Island Hawk-Owl, Norfolk Island Gerygone, Christmas Island White-eye, Slender-billed White-eye; **Near Threatened**: Letter-winged Kite, Grey Falcon, Long-billed Corella, Rufous Scrub-bird.

lands, as well as clearance of mallee for fruit production (Lemly et al. 2000, Garnett et al. 2003b). Such developments became possible because of mechanisation and it was only lack of capital that prevented more rapid environmental degradation.

Away from the agricultural lands, cattle and sheep numbers increased steadily after the first decade, maintaining pressure on grazed lands and taking advantage of newly cleared areas. Traditional fire management probably persisted in only the least-developed parts of the country. Elsewhere, burning, if undertaken at all, aimed to prevent wildfires or promote short-term benefits for cattle. In the wetter parts of Australia fire free periods were interspersed with major wild fires; elsewhere fires are also likely to have become larger but more intermittent. Rabbit numbers escalated, feral deer and Cane Toads (*Bufo marinus*) became established and mouse plagues became a regular feature of cereal growing areas (Bolton 1981). Exotic plants also proliferated. This was highlighted by the spread of Prickly Pear (*Opuntia* spp.), which covered large areas of south-east Queensland until controlled by introduction of a moth.

Intensification of land use inevitably had environmental costs. Foremost among these for birds was extinction of the Paradise Parrot; as of 2007 the only mainland bird species to become extinct. Last unquestionably seen in 1928 by naturalist Cyril Jerrard (Figure 2), the exact causes of its disappearance are still uncertain, but changed grazing and fire management are strongly implicated, with trapping and even Prickly Pear proliferation being at least locally important. Rumours of persistence have so far proved unfounded, and become ever more unlikely. In the same period, the Noisy Scrub-bird in Western Australia became so rare it was thought to be extinct (Campbell 1915). We think all three declining Tasmanian species would have been vulnerable during this period, the Swift and Orange-bellied Parrots being affected by changes on both sides of Bass Strait. It was also probably during this period that habitat fragmentation of the grassy woodlands and mallee first began to have significant effects on populations of birds. Regent Honeyeater (*Xanthomyza phrygia*) and Superb Parrot (*Polytelis swainsonii*) appear to have suffered the most, but Red Goshawk (*Erythrotriorchis radiatus*), Malleefowl (*Leipoa ocellata*), Speckled Warbler (*Chthonicola sagittata*), Painted Honeyeater (*Grantiella picta*), Red-lored Whistler (*Pachycephala rufogularis*) and Diamond Firetail (*Stagonopleura guttata*) began to decline at this time,

Figure 2. Cyril Jerrard responded to Alec Chisholm's appeal for news of the Paradise Parrot in 1921 with observations on his property in the Burnett River Valley. His photographs of the bird are the only ones ever taken in the wild. Photograph by Graham Jerrard.

with many populations becoming isolated and more vulnerable to local extinction. Further west, ongoing heavy grazing of Bluebush (*Atriplex* spp.) by sheep appears to have been responsible for disappearance of the Thick-billed Grasswren in NSW (NSW National Parks and Wildlife Service 2002) and rapid decline across the rest of its range. The disappearance of the Princess Parrot (*Polytelis alexandrae*) from the eastern-part of its range around this time and the apparent fragmentation of Chestnut-breasted Whiteface (*Aphelocephala pectoralis*) populations, may also be attributable to overgrazing, though both species are so rare and mysterious that even a decline is difficult to substantiate, let alone its timing. Nevertheless the perception, during the 1930s, that research into overgrazing and soil erosion in arid South Australia was required (Ratcliffe 1938) suggests the environmental damage of overstocking in the 19th century had continued. In the tropical savannas intensification of grazing and loss of traditional burning probably contributed to decline of the Chestnut-backed Button-quail (*Turnix castanota*), Buff-breasted Button-quail (*T. olivii*) and Golden-shouldered Parrot (*Psephotus chrysopterygius*) (Garnett and Crowley 2000).

Of the offshore islands, Lord Howe was the most affected during this period. In the decade following the wreck of the S. S. *Makambo* in 1918, the island lost six endemic taxa including two species (McAllan et al. 2004). The loss of the Lord Howe Gerygone (*Gerygone insularis*), Robust White-eye (*Zosterops strenuus*) and the Lord Howe subspecies of Tasman Starling (*Aplonis fusca hulliana*) has been attributed to predation by Black Rats that swam ashore from the wrecked ship. Black Rats are thought to have arrived on Norfolk Island for the first time during the 1940s (Robinson 1997), and immediately eliminated the only Australian population of Long-tailed Triller (*Lalage leucopyga leucopyga*), which has not been seen since 1942 (Schodde et al. 1983). The only other population of Tasman Starling, the Norfolk Island subspecies (*A. f. fusca*), disappeared around the same time, probably from the same cause. On Christmas Island phosphate mining began but was limited in extent. Black Rats were introduced there as well but appear to have been kept out of the forest by the native crabs. Yellow Crazy Ants (*Anoplolepis gracilipes*) were also introduced in this period, having first been recorded there in 1913, but did not immediately proliferate (O'Dowd et al. 1999).

Although environmental degradation was accelerating, conservation measures aimed at ensuring persistence of threatened birds also became more organised. The Royal Australasian Ornithologists Union (RAOU) was formed with, among its objectives, the creation of reserves and the enforcement of wildlife laws (Anon. 1901) and was soon joined by numerous other more local bird clubs, natural history societies, and societies for the preservation of Australian wildlife. While the primary concern of such clubs was usually the collection of knowledge and enjoyment of nature, their existence highlighted the increasing belief that species conservation was a legitimate activity. One of the early presidents of the RAOU, Arthur Mattingley (Figure 3), was particularly forceful in his advocacy of protection for breeding egrets, his article and photographs in the RAOU's journal *Emu* playing a key part in stopping the international trade in plumes (Robin 2001). There was also a realisation that some species were becoming scarce (e.g., Campbell

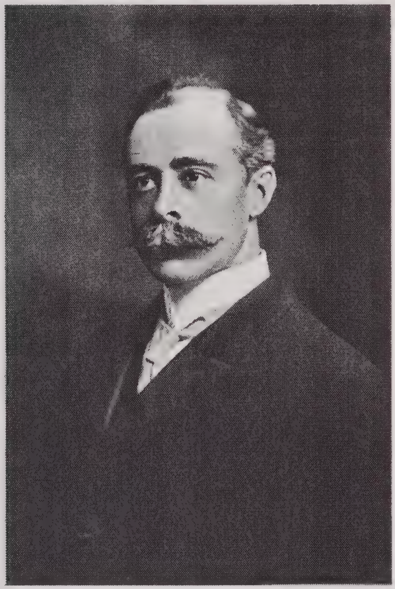

Figure 3. Arthur Mattingley, eighth president of the Royal Australasian Ornithologists Union, was among the first ornithologists to recognize the importance of habitat in threatened species conservation and tried to do something to preserve it. He was also instrumental in stopping the international trade in egret plumes. Photograph courtesy of Birds Australia.

1915), and during the 1920s, journalist A. H. Chisholm led a campaign to search for the Paradise Parrot (Chisholm 1922).

Most conservation measures were of a general nature. First, following the other States, Queensland and Tasmania declared significant national parks. These were usually in sites of limited economic potential, with the largest parks being declared away from urban centres, but have since proved excellent investments for protecting threatened species. Second, the first national quarantine legislation restricting introduction of plants and animals was passed in 1909 (Nairn et al. 1996). Third, a range of specific measures aimed at controlling hunting had some success. Protection of Cape Barren Geese in the Furneaux Group allowed expansion of that population, although it was unlikely the species ever met IUCN threatened criteria. Transfer of species to islands in the name of conservation was also popular during this period, though no threatened species were protected by this means. Failed transfers involving threatened species included Island Thrushes (*Turdus poliocephalus*) from Norfolk to Lord Howe Island (McAllan et al. 2004), Malleefowl to Kangaroo Island from the mainland (Baxter 1995), and Christmas Island Imperial-Pigeons (*Ducula whartoni*) to Cocos-Keeling Islands (Stokes et al. 1984). A few transfers did succeed, but with little conservation benefit. For instance, Christmas Island White-eyes (*Zosterops natalis*) temporarily established a small population on Cocos-Keeling Islands (Stokes et al. 1984) and Cape Barren Geese are now so numerous on Kangaroo Island, where they were introduced in 1922, 1933, and 1935 (Baxter 1995), that they have to be controlled. Some of the introductions had interesting justifications. Emus were introduced to Maria Island off Tasmania with the intention of breeding a small form resembling the extinct Tasmanian subspecies (C. Cook pers. comm.) and the successful introduction of the Superb Lyrebird (*Menura novaehollandiae*) near Mt. Field in Tasmania, would have been laudable had fox predation been the threat it was believed to be (Le Souef 1910).

At least two species that had earlier been threatened began to adapt to the new conditions. A series of ecological changes favoured the Long-billed Corella. The first was introduction and spread of a small South African plant, *Romulea rosea*, which had a small tuber that the cockatoos were pre-adapted to exploit. The second was agricultural diversification, with wheat (*Triticum* sp.) and barley (*Hordeum vulgare*) increasingly being grown in the habitat of the small remaining populations of corella so that wheat became available along roadsides and in fallow paddocks (Emison et al. 1994). The cause of decline of the Turquoise Parrot in the late 19th century remains uncertain. However, the prevalence in its diet of seed of introduced plants, the widespread daisy Cape Weed (*Arctotheca calendula*) and Quaking Grass (*Briza* spp.) (Quin 1990) suggests that it may have declined when its favoured food species were grazed by sheep and cattle; it recovered when it learned to eat new foods.

1950-2000 (Table 5).—By 1950 Australia was entering a golden era of confidence and wealth. The post-war stringencies had eased, the soldiers were home and the world wanted as much Australian wool and wheat as the country could produce. During the 1950s and 1960s huge areas of mallee were cleared in New South Wales, Victoria, South Australia and south-west Western Australia. By the 1970s 90% of all native vegetation had been cleared from Western Australian wheat belt (Saunders and Ingram 1995). Only the presence of mallee on land considered too sandy or poor for agriculture saved the east from similar destruction. For many species the remaining patches of habitat were too small, even if populations were able to linger for decades. During the same period most lowland rainforest was cleared in north Queensland, most of the dry rainforest of central and south-east Queensland, locally termed brigalow, was transformed into pasture, many of the remaining patches of grassy woodland were removed from the plains of New South Wales, Victoria, and Tasmania and most natural grassland was ploughed under in Victoria and South Australia. Large scale irrigation created some new wetland habitats, but a high proportion of reedy swamps in southern and eastern Australia were grazed, cleared, drained, salinised, or invaded by exotic plants. The first intimations of climate change could be detected (Hughes 2003), although with difficulty against the highly variable climatic background.

The agricultural intensification had profound effects on birds. In both south-western and south-eastern Australia the status of many of the mallee and woodland species continued to decline. Sometimes threats combined, as with the Bush Stone-curlew (*Burhinus grallarius*), which was affected by clearing and fox predation. Many more species that had contracted in the southern parts of their range would be considered threatened were they not also broadly distributed across less disturbed parts of semi-arid and tropical Australia. Most threatened species of the south-east began to decline earlier in the century, but clearance in the 1950s and 1960s added the widespread but elusive Western Whipbird onto the near threatened list. The effects of this clearance on Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) only became apparent in the 1970s (Saunders and Curry 1990). Evidence showing a decline in its forest-dwelling congener, Baudin's Black-Cockatoo (*Calyptorhynchus baudinii*), is even more recent. Research since 2000 shows how infrequently the species has been breeding and the extent to which its breeding success is being compromised by competition for nest hollows with

TABLE 5. Change in status of Australian species postulated for 1950-2000. All taxa not listed are thought to have been Least Concern throughout.

Status 1950	Status 2000	Name	Proposed reasons
Critical	Endangered	Lord Howe Woodhen	Successful control of pigs and cats
Critical	Vulnerable	Noisy Scrub-bird	Successful reintroductions and habitat protection and management
Endangered	Critical	White-chested White-eye	Rat predation
Endangered	Vulnerable	Western Bristlebird	Successful habitat protection and management
Vulnerable	Critical	Abbott's Booby	Rapid spread of introduced ants
		Christmas Island Frigatebird	Loss of nesting habitat, rapid spread of introduced ants
		Christmas Island Imperial-Pigeon	Rapid spread of introduced ants
		Orange-bellied Parrot	Changed fire regime in breeding habitat, cultivation of habitat and overgrazing by sheep in non-breeding habitat
		Christmas Island Hawk-Owl	Rapid spread of introduced ants
		Christmas Island White-eye	Rapid spread of introduced ants
Vulnerable	Endangered	Australasian Bittern	Habitat drainage
		Plains-wanderer	Habitat clearance for agriculture
		Swift Parrot	Habitat clearance for agriculture
		Golden-shouldered Parrot	Changed fire regime, Overgrazing by cattle, shrub invasion of grassland
		Forty-spotted Pardalote	Habitat clearance for agriculture, invasion of habitat by Noisy Miner *Manorina melanocephala*
		Regent Honeyeater	Habitat clearance for agriculture
		Black-eared Miner	Habitat clearance for agriculture, invasion of habitat by Yellow-throated Miner *Manorina flavigula*

		Slender-billed White-eye	Predation by introduced rats, invasion of habitat by exotic weeds
Vulnerable	Least Concern	Turquoise Parrot	Adaptation to new foods, numbers increasing
		Thick-billed Grasswren	Decline ceased and remaiing populations apparently stable; species still relatively numerous and widespread
Near Threatened	Vulnerable	Malleefowl	Habitat clearance for agriculture
		Red Goshawk	Habitat clearance for agriculture
		Superb Parrot	Habitat clearance for agriculture
Near Threatened	Least Concern	Long-billed Corella	Adaptation to new food sources and numbers increasing
Least Concern	Endangered	Black-browed Albatross *Thalassarche melanophrys*	By-catch from long-line fishing (greatest loss in Atlantic population)
		Carnaby's Black-Cockatoo *Calyptorhynchus latirostris*	Habitat clearance for agriculture
		Baudin's Black-Cockatoo *Calyptorhynchus baudinii*	Habitat clearance for timber, competition for nest hollows with feral bees
		Gouldian Finch *Erythrura gouldiae*	Overgrazing by cattle, increased frequency and area burnt by deliberately lit fires, disease
Least Concern	Vulnerable	Southern Cassowary *Casuarius casuarius*	Habitat clearance for agriculture
		Rockhopper Penguin *Eudyptes chrysocome*	Climate change, warming of sub-Antarctic waters
		Southern Giant-Petrel *Macronectes giganteus*	By-catch from long-line fishing
		Gould's Petrel *Pterodroma leucoptera*	Predation by introduced rats (New Caledonia, unproven), Pied Currawongs *Strepera graculina* (Australia, proven), downward trend in Australian population successfully reversed.
		Wandering Albatross *Diomedea exulans*	By-catch from long-line fishing
		Grey-headed Albatross *Thalassarche chrysostoma*	By-catch from long-line fishing
		Sarus Crane *Grus antigone*	Hunting and habitat loss in Asia (not threatened in Australia)

		White-throated Grasswren *Amytornis woodwardi*	Increased frequency and area burnt by deliberately lit fires
Least Concern	Near Threatened	Blue-billed Duck *Oxyura australis*	Habitat drainage
		Gentoo Penguin *Pygoscelis papua*	Climate change, warming of sub-Antarctic waters
		Northern Giant-Petrel *Macronectes halli*	By-catch from long-line fishing
		Grey Petrel *Procellaria cinerea*	By-catch from long-line fishing
		Sooty Shearwater *Puffinus griseus*	Possibly by-catch from long-line fishing
		Light-mantled Albatross *Phoebetria palpebrata*	By-catch from long-line fishing
		Black-necked Stork *Ephippiorhynchus asiaticus*	Hunting and habitat loss in Asia (not threatened in Australia)
		Bush Stone-curlew *Burhinus grallarius*	Habitat clearance for agriculture, predation by introduced foxes
		Beach Stone-curlew *Esacus neglectus*	Disturbance on beaches (not threatened in Australia)
		Hooded Plover *Thinornis rubricollis*	Disturbance on beaches
		Flock Bronzewing *Phaps histrionica*	Overgrazing by cattle
		Partridge Pigeon *Geophaps smithii*	Increased frequency and area burnt by deliberately lit fires
		New Zealand Pigeon *Hemiphaga novaeseelandiae*	Extinct on Norfolk Island 1850-1900, global status in New Zealand declined from predation by introduced possums.
		Carpentarian Grasswren *Amytornis dorotheae*	Increased frequency and area burnt by deliberately lit fires, invasion of habitat by introduced plants
		Flame Robin *Petroica phoenicea*	Climate change, warming of Australian high country
		Western Whipbird *Psophodes nigrogularis*	Habitat clearance for agriculture, increased frequency and area burnt by deliberately lit fires
		Black-throated Finch *Poephila cincta*	Overgrazing by sheep and cattle, changed fire regime, shrub invasion of grassland

	Star Finch *Neochmia ruficauda*	Overgrazing by cattle, shrub invasion of grassland
	Pictorella Mannikin *Heteromunia pectoralis*	Overgrazing by cattle, possibly disease

Extinct species, or species of conservation concern with status unchanged during period: **Extinct:** King Island Emu, Kangaroo Island Emu, White Gallinule, Norfolk Island Ground-Dove, Paradise Parrot, Norfolk Island Kaka, Lord Howe Gerygone, Robust White-eye, Tasman Starling; **Critical:** Night Parrot; Endangered: Buff-breasted Button-quail, Norfolk Island Green Parrot, Eastern Bristlebird; **Vulnerable:** Royal Penguin, Providence Petrel, Black-breasted Button-quail, Albert's Lyrebird, Mallee Emu-wren, Norfolk Island Gerygone; **Near Threatened:** Shy Albatross, Letter-winged Kite, Grey Falcon, Australian Bustard, Chestnut-backed Button-quail, Princess Parrot, Rufous Scrub-bird, Speckled Warbler, Chestnut-breasted Whiteface, Painted Honeyeater, Red-lored Whistler, Diamond Firetail.

introduced bees and, possibly, increasing numbers of Australian Wood Duck (*Chenonetta jubata*) that have benefited from nearby agricultural intensification (BirdLife International 2005a). Declines as a result of clearance also occurred in the tropics, where Southern Cassowary (*Casuarius casuarius*) populations have been reduced and fragmented by removal of rainforest, though other rainforest endemics have so far proved resilient. In the savannas, additional declines occurred among granivorous birds in particular (Franklin 1999), with the Flock Bronzewing (*Phaps histrionica*) suffering from overgrazing in the north just as it had in western New South Wales in the previous century and the Gouldian Finch (*Erythrura gouldiae*) disappearing from much of its range, apparently as a result of grazing and altered fire regimes, possibly in combination with parasites. The same threats are likely to have affected Black-throated Finch (*Poephila cincta*), Star Finch (*Neochmia ruficauda*), and Pictorella Mannikin (*Heteromunia pectoralis*), while the Partridge Pigeon (*Geophaps smithii*) and White-throated Grasswren (*Amytornis woodwardi*) have been affected primarily by the increased area and intensity of fire following disruptions to Indigenous burning practices. Increasing upland temperature as a result of climate change seems the only explanation for the dramatic decline in range and abundance of the Flame Robin (*Petroica phoenicea*) in Tasmania and the Australian Alps. It was reported far more frequently in the first atlas of Australian birds (1977-1981: Blakers et al. 1984) than the second (1988-2002: Barrett et al. 2003, Garnett et al. 2003b). A more direct consequence of human activity is the decline of the Hooded Plover (*Thinornis rubricollis*) as a result of intensification of recreation along south-eastern beaches, although the species remains relatively secure on south-west salt lakes. However lakes in both south-western and south-eastern Australia became less suitable for Blue-billed Duck (*Oxyura australis*), which became increasingly restricted as wetlands were drained.

Further extinctions occurred on Norfolk and Macquarie islands and the integrity of the least altered of the six oceanic provinces, Christmas Island, was substantially threatened for the first time. On Norfolk Island, Black Rats contributed to the continued decline of Norfolk Island Green Parrot (*Cyanoramphus cookii*) and, probably, the White-chested White-eye (*Zosterops albogularis*). On Macquarie Island, cats and rats caused the local extinction of the Grey Petrel (*Procellaria cinerea*) as a breeding species. On Christmas Island, 20% of the island was cleared for phosphate mining with a loading ramp built adjacent to one of three known breeding colonies of Christmas Island Frigatebird (*Fregata andrewsi*). Then, in the 1990s, a drought on Christmas Island allowed proliferation of Yellow Crazy Ants (O'Dowd et al. 1999), which had the potential to affect all the endemic taxa within a relatively short time if allowed to continue, though research subsequently suggested that the ants had not yet had an impact on the bird species there (D. James pers. comm.). The only island on which no decline in status was recorded during this period was Lord Howe Island; by 1950 most of its endemic taxa were gone.

For the first time seabirds visiting Australia from other parts of the world were threatened in a major way. Large numbers of albatrosses and petrels died after taking bait from the hooks of long-line fishing boats (Brothers 1991), with several species breeding on Australian islands being affected including Northern Giant-Petrel (*Macronectes halli*), Southern Giant-Petrel (*M. giganteus*), Grey Petrel, Sooty Shearwater (*Puffinus griseus*), Wandering Albatross (*Diomedea exulans*), Grey-headed Albatross (*Thalassarche chrysostoma*), Black-browed Albatross (*Thalassarche melanophrys*), and Light-mantled Albatross (*Phoebetria palpebrata*). Rapid declines among some species of subantarctic penguin, including Rockhopper Penguin (*Eudyptes chrysocome*) and Gentoo Penguin (*Pygoscelis papua*), largely due to local factors on islands away from Australia, have also caused their status to be upgraded (BirdLife International 2005b). For some species that have declined elsewhere, Australia remains a stronghold. Black-necked Stork (*Ephippiorhynchus asiaticus*), Sarus Crane (*Grus antigone*) and Beach

Stone-curlew (*Esacus neglectus*) have declined in Asia, but remain throughout their historical range in tropical Australia and do not currently face more than localised threats from disturbance. Sarus Crane may even have benefited from conversion of the Atherton tablelands from forest to intensive agriculture (Garnett and Crowley 2000).

While the extent and intensity of environmental change accelerated in the second half of the 20th century, and the numbers of threatened bird species correspondingly increased, the situation would have been worse had there not been a concerted effort to recover threatened species (Table 6, Figure 4). On mainland Australia a dozen species would have been more threatened or even extinct were it not for successful conservation management. Much of the benefit has been simply from protection of habitat. Plains-wanderer, Noisy Scrub-bird, Australasian Bittern, Forty-spotted Pardalote, Eastern Bristlebird, Black-eared Miner (*Manorina melanotis*), Mallee Emu-wren (*Stipiturus mallee*), Western Bristlebird, Western Whipbird, and Red-lored Whistler were all less threatened in 2000 as a result of habitat being protected in reserves. The Noisy Scrub-bird in particular would have become extinct had it not been rediscovered just before a residential development was to occur in the one place it had persisted, and had not Harley Webster (Figure 5), with assistance from HRH the Duke of Edinburgh, Prince Phillip, and others campaigned so vigorously to have

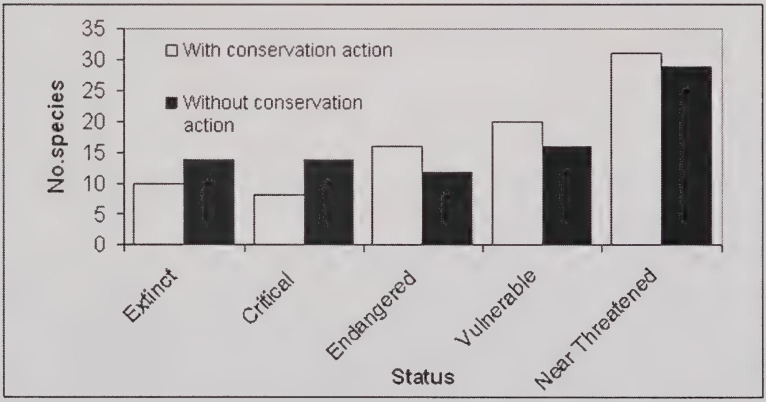

Figure 4. Postulated effect of conservation management on Australian bird status in 2000.

TABLE 6. Effects of conservation management on the status of Australian bird species in 2000.

Predicted status 2000 without conservation management	Status 2000	Species	Nature of management
Extinct	Critical	Orange-bellied Parrot	Control of nest competitors, supplementary feeding, captive breeding and release
		White-chested White-eye	Protection of habitat from clearance
Extinct	Endangered	Norfolk Island Green Parrot	Protection of habitat from clearance, predator control, erection of nestboxes
Extinct	Vulnerable	Noisy Scrub-bird	Protection of habitat from clearance and fire, translocation
Critical	Endangered	Australasian Bittern	Protection of habitat from drainage
		Lord Howe Woodhen	Removal of predators, captive breeding and release
		Plains-wanderer	Protection of habitat from clearance and overgrazing
		Forty-spotted Pardalote	Protection of habitat from clearance
		Eastern Bristlebird	Protection of habitat from clearance and fire
		Regent Honeyeater	Protection of habitat from clearance
		Black-eared Miner	Protection of habitat from fire, translocation
		Slender-billed White-eye	Protection of habitat from clearance
Endangered	Vulnerable	Gould's Petrel	Predator control, removal of harmful vegetation, translocation
		Mallee Emu-wren	Protection of habitat from clearance
		Western Bristlebird	Protection of habitat from clearance and fire
Endangered	Near Threatened	Western Whipbird	Protection of habitat from clearance and fire
		Red-lored Whistler	Protection of habitat from clearance and fire

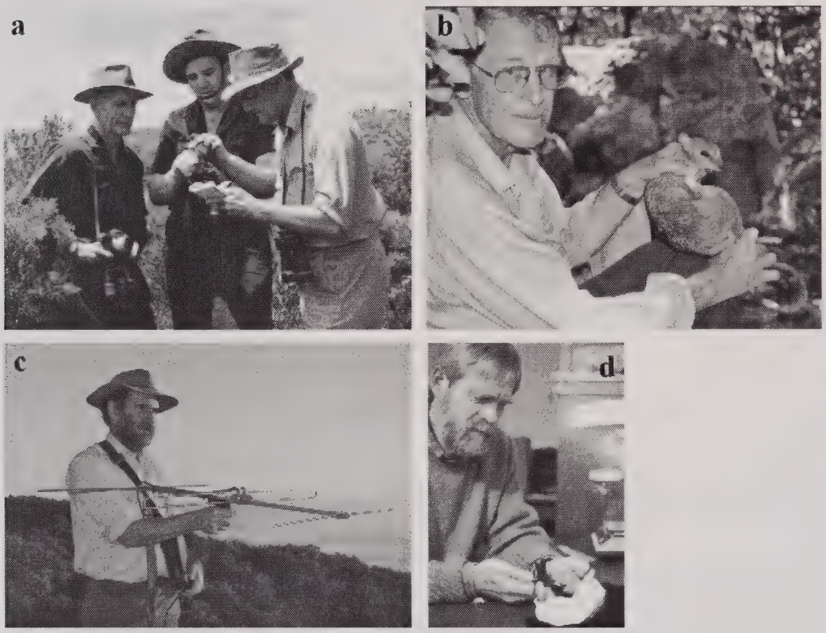

Figure 5. One small decision by local government could have sent the Noisy Scrub-bird extinct. Two Peoples Bay was destined for development in 1961 when Harley Webster and others became aware that this species, lost for 72 years, had survived there. Here (figure 5a) Webster (left), Robert Stranger (centre) and Dom Serventy (right) hold the first scrub-bird caught alive (photograph by Sydney Erickson). Over the next 45 years Andrew Burbidge (figure 5b), Allan Burbidge (figure 5c) and Alan Danks (figure 5d) were notable among a host of scientists and support staff who have given the species greater security. Photographs by Merilyn, Michael, and Allan Burbidge respectively.

that development stopped (Frith 1973). Even then only the persistence of a group of Western Australian scientists and dedicated conservation managers (Figure 5), such as Andrew Burbidge, Allan Burbidge, Alan Danks, and Sarah Comer, has allowed this species and others from the same area like the Western Bristlebird and Western Whipbird to have a more secure status. Similarly a range of other species has benefited from targeted management, each species having champions who have often spent decades identifying problems and gradually instituting effective management. Fine examples of these are David Pridell and Nicolas Carlile with Gould's Petrel (Figure 6), David Baker-Gabb

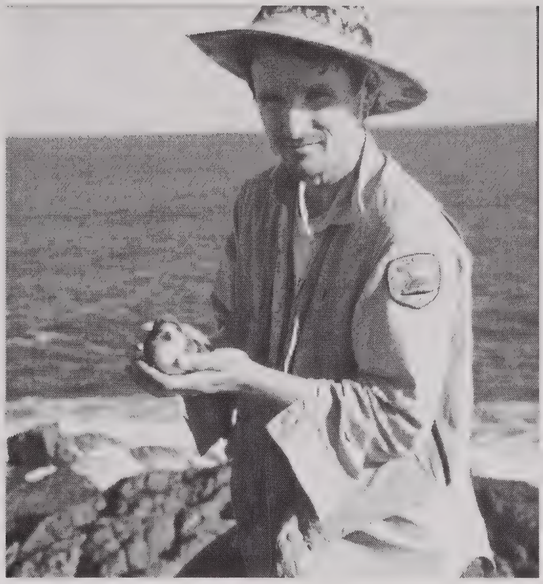

Figure 6. The only breeding population of Gould's Petrel in Australia, on Cabbage Tree Island near Newcastle, was fast disappearing when Nicolas Carlile (above) and his colleague David Priddel began work on them in the 1990s. They removed predators, eradicated rabbits and controlled weeds until the population began to recover. They then pioneered translocation of petrels to another island to diminish the risk. Photograph by Michael Jarman.

(Figure 7) with Plains-wanderer, Peter Menkhorst (Figure 8) and Mark Holdsworth (Figure 9) with Orange-bellied Parrot, Sally Bryant with Forty-spotted Pardalote, David Geering (Figure 10) with Regent Honeyeater, and Rohan Clarke (Figure 11) with Black-eared Miner, although there have been many others. Also in each case there have been teams of people who have contributed everything from working with private owners of habitat to active fire management and even, in the case of Gould's Petrel, Noisy Scrub-bird, and Black-eared Miner, successful translocation (see recovery plans, Department of Environment and Water Resources 2007). There have also been dedicat-

Figure 7. David Baker-Gabb's research on Plains-wanderer and Red Goshawk has underpinned a series of successful moves to protect habitat and institute evidence-based conservation management for these species. Photograph by Leigh Ahern.

ed individuals too numerous to mention who have worked with species that have not yet started to recover, or with threatened subspecies or populations of species that are still secure.

On the islands, conservation initiatives during the last 50 years have also had considerable success. Feral cats and pigs have been removed from Lord Howe Islands after the early work of John Disney and Peter Fullagar, leading to an increase in Lord Howe Woodhen and Little Shearwaters (*Puffinus assimilis*). Introduced Wekas and feral cats have been removed from Macquarie Island, a project long overseen by Geof Copson, following which Grey Petrels have returned to breed, and White-headed Petrel (*Pterodroma lessonii*) numbers have increased. On Norfolk Island, intensive management of nesting parrots and rat baiting, which began when John Hicks was Government Conservator on the island, have allowed the population of Norfolk Island Green Parrots to increase, while the population of Slender-billed White-eye (*Zosterops tenuirostris*) is holding its own within the rat-baited protected area.

Figure 8. Peter Menkhorst is one of a host of government officials who have dedicated their careers to threatened species. Peter's work at many levels in the Victorian government has been instrumental in conservation of the Regent Honeyeater, the Helmeted Honeyeater (*Lichenostomus melanops cassidix*) and the Orange-bellied Parrot among others. Photograph by Michael Shelton.

Removal of European Rabbits from nearby Phillip Island may have been instrumental in allowing Providence Petrels to breed there again after a presumed absence of nearly 200 years.

These recent successes in the management of threatened species have been the result of concerted campaigns aimed particularly at threatened species management that began in the 1960s and had their origins even earlier in the century (Robin 2001). By the 1970s works like Harry Frith's *Wildlife Conservation* (Frith 1973) were including synopses of threatened birds and the IUCN was producing the first of its red lists (King 1977). In Australia, the work was aided by much

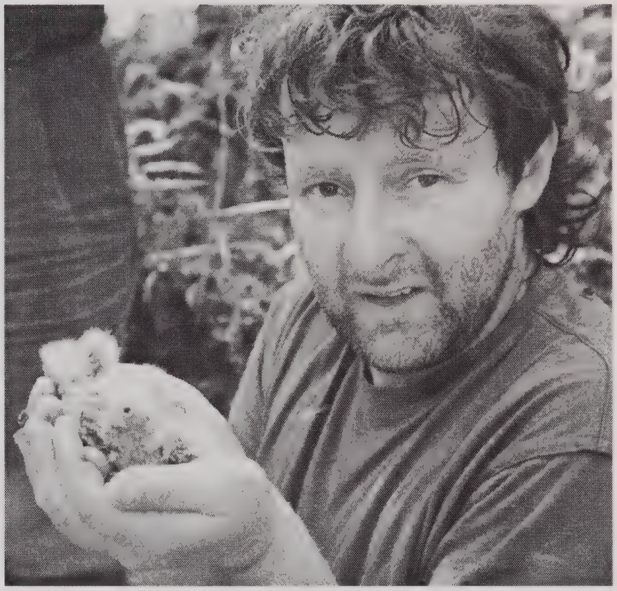

Figure 9. Mark Holdsworth's dedication to the Orange-bellied Parrot since 1979 has played a major role in preventing its extinction in south-western Tasmania where the population of 200 persists. Photograph by Sally Bryant.

increased knowledge of bird distributions (Blakers et al. 1984, Barrett et al. 2003), which allowed Joost Brouwer to instigate the first analysis of Australian threatened birds in 1990 (Brouwer and Garnett 1990). An understanding of processes threatening birds and the likely consequences of current trends have led the way in the political debate on conservation of threatened species (e.g., Recher and Lim 1990, Recher 1999). The political support generated by the campaigns has led to substantial and extended support from conservation agencies and volunteers, particularly for the most threatened and distinctive bird taxa (Garnett et al. 2003a). The value of volunteered time, which did not include the many unpaid hours spent by researchers who consider saving threatened species their vocation, was over a quarter of all funds dedicated to threatened species management from 1992 to 2000 (Garnett et al. 2003a). Commonwealth government funding was pivotal; the Australian National Parks and Wildlife Service, which changed

Figure 10. David Geering's name is permanently associated with the Regent Honeyeater with which he has worked for several decades. The efforts of David and his team at Capertee Valley near Lithgow, NSW, have been instrumental in conserving this most important patch of remnant habitat. Photograph by Alice Geering.

successively into the Australian Nature Conservation Agency, the Department of Environment and Heritage, and the Department of Environment and Water Resources, ran a successful threatened species and communities unit from the early 1990s that supported the development of two actions plans for Australian birds (Garnett 1992, Garnett and Crowley 2000) and provided the bulk of the funding dedicated to threatened species management. The Commonwealth also funded volunteer support networks dedicated to threatened species such as World Wide Fund for Nature, Australia's Threatened Species Network. and Birds Australia's Threatened Bird Network. Concern for threatened species has also had a major role in campaigns to protect habitat, thus preventing other species from ever reaching threatened species lists. By the end of the century a list of threatened species developed by the Australian and New Zealand Environment Council in the 1980s had been incorporated into national legislation, the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act). There is equivalent legislation in every state and territory requiring that impacts on

Figure 11. Rohan Clarke has spearheaded the recovery effort for the Black-eared Miner, ensuring the dwindling and isolated populations were translocated to other sites where suitable habitat remained, spreading the risk from catastrophic fire or invasion by Yellow-throated Miner, with which it hybridizes. Photograph by John Ewen: Rohan is holding the equally threatened New Zealand Stitchbird (*Notiomystis cincta*).

threatened species be considered with every development. While rarely tested in court, the presence of such legislation discouraged some potentially destructive developments. Discouraging development in sites where threatened species persist may not have arrested fundamental environmental trends, but it may at least have staved off further extinctions.

Since 2000.—In the seven years since the start of the new millennium the only major environmental event not a continuation of previous trends has been the substantial tightening of vegetation clearance legislation in Queensland, which is intended to end clearing in that State after 2005. The cessation of what had previously been extremely rapid destruction has made it possible to remove the Speckled Warbler from the IUCN threatened species list since it has been able to persist in relatively small fragments.

Elsewhere persistent management of the long-threatened species of south-west Australia was shown to be justified when, in 2004, a wildfire removed much of the habitat of the Noisy Scrub-bird (Comer et al. 2005). Because translocations had been so successful its status has so far remained unchanged. Fire has been less well-controlled in other parts of the country: in 2007 the Mallee Emu-wren was listed as endangered after loss of almost all populations in South Australia and increasing fragmentation of populations left in Victoria (D. Paton pers. comm., S. Mustoe pers. comm., R. Clarke pers. comm.) and Carpentarian Grasswren (*Amytornis dorotheae*) has all but disappeared from the Northern Territory for much the same reason (J. Perry pers. comm.). In contrast the fear that the Pictorella Mannikin would follow the trend of the Gouldian Finch in northern Australia has proved unfounded and the species was downlisted. Developments overseas have also affected the status of some migrant Australian birds. Black-tailed Godwit (*Limosa limosa*) was listed as near threatened in 2006 after sustained global declines (BirdLife International 2006) and several albatrosses have been uplisted to endangered as their numbers continue to plummet as a result of long-line fishing (BirdLife International 2004). Another seabird, the Fairy Tern (*Sterna nereis*) has declined so precipitously in eastern Australia that it was listed as vulnerable in 2007. The greatest decline was because management of the Murray River killed the fish in the Coorong (D. Paton pers. comm.).

Continued intensive feral animal management on Norfolk and Lord Howe is at least enabling populations to persist and in some areas, leading to a rapid increase in populations of seabirds. On both islands, rat eradication is being contemplated. On Macquarie Island feral cat eradication has had the unintended consequence of allowing the proliferation of feral European Rabbits, with dire consequences for the vegetation among which seabirds nest. Eradication of rabbits is now planned for 2008. On Christmas Island control programs have reduced the threat from exotic ants, at least in the short term, and a proposal to resume phosphate mining was disallowed.

However, while action has continued, threats have increased and amendments to legislation and policy have not been to the advantage of threatened species. Listing of species under the EPBC Act is now more a matter of ministerial discretion, recovery plans are no longer required, and most funds are devolved from federal government to regional bodies while responsibility for threatened species management remains with the states and territories, which rarely get dedicated funds. Land clearing continues, or, as in the Northern Territory, is held in check only through a moratorium. While over the last six years the global status of five Australian species has improved, that of seven has declined. While no more have become extinct, it would be a mistake to suggest that the downward trend has been reversed.

THE FUTURE

There are three main reasons why it is difficult to predict future trends in status based purely on numerical trends. The first is methodological. Gaps in the historical record mean that any extrapolation will be based on data that have a high degree of inherent error. The only points where status is reasonably well known are 1750, assuming that any species not inherently rare at that time had reached some level of ecological balance with Indigenous land use, and 2000, the most recent national assessment. Even there, subsequent trends can lead to changes in status (Garnett et al. 2003c).

The second reason is that we can assume that the most sensitive species are already extinct, particularly those on islands. On the mainland even species with restricted ranges are likely to have been through population bottlenecks within the recent evolutionary past, and are thus partially pre-adapted to the changes now being wrought on their environment. Even those that evolved in extensive continuous landscapes and are particularly ill-adapted to habitat fragmentation, such as Grey-crowned Babbler (*Pomatostomus temporalis*) and Brown Treecreeper (*Climacteris picumnus*), have such extensive distributions in non-agricultural zones that they are unlikely to meet IUCN threatened species criteria in the next 50 years, even if some of their constituent subspecies do. Basically, despite substantial modification of the environment by Europeans, 85% of Australian species are still of least concern.

The third is the effort being made to conserve threatened species in Australia, which has already had a marked effect on reducing extinction rates (Figure 4). It is telling in this graph, that the achievements for conservation management tend to be among the most threatened species; conservation management has so far had little effect on preventing species from becoming near threatened in the first place. While a number of least concern species have benefited from protected areas and controls on wildlife exploitation, only some of the most threatened species have had a change in status after conservation management. Nevertheless the recent legislation to stop land clearance in Queensland may do just that for some of the woodland species that have adversely been affected by clearance further south, although clearance continues despite legislation in other states and could easily resume elsewhere with a change in political will.

However, while simple extrapolation of trends may be questionable, there is merit in assessing likely trends on a species by species basis. In particular, there are a number of processes for which local conservation management has no answer short of captive breeding and cryogenesis.

Foremost amongst these is climate change. Rising water temperatures may also be behind declines in penguin numbers (Cunningham and Moors 1994). Temperature increases may also be affecting upland birds in southern Australia, of which the Flame Robin is the most affected. Several others could follow, including most of the species with small ranges in cooler southern Australia (Garnett et al. 2003b). The southwest of the continent is predicted to become much drier, which may lead to a reduction in habitat productivity and a higher frequency of fires. It has been predicted that most of the endemic species of the wet tropics are likely to be affected by increased temperatures in coming decades (Williams et al. 2003) and that climate change will become the principal threatening process for birds in tropical Australia over the next 30 years from a combination of temperature and sea level increases (Garnett and Brook in press).

The second inevitable threat is the long lag time between fragmentation and effect, which may eventually have implications for a far wider range of woodland species than are currently listed as threatened (Olsen et al. 2005).

On the basis of these threats, and on the assumption that the role of history is to forecast the future, we are predicting that by 2050 the changes shown in Figure 12 and Table 7 will have occurred. In these predictions, declines for reasons of climate change and lag effects are partially offset by continued trends in improvement for those species for which intensive conservation work is currently being undertaken (Table 7). Despite such mitigating circumstances, the curve produced is not very different from a continuation of current exponential trends (Figure 1). While we think intensive management should be able to prevent extinction, we think nearly 20% of the 640 bird species present in Australia in 1750 will be of conservation concern in 2050.

TABLE 7. Future prospects of Australian bird species 2000-2050 (shaded species are predicted to improve in status, unshaded species to decline)

Status 2000	Status 2050	Name	Proposed reasons
Critical	Extinct	Night Parrot	Remaining undiscovered populations wink out
Critical	Endangered	White-chested White-eye	Rat eradication undertaken in at least part of range
Critical	Vulnerable	Christmas Island White-eye	Crazy ant control continued
		Christmas Island Imperial-Pigeon	Crazy ant control continued
Endangered	Critical	Australasian Bittern	Lower rainfall in core habitat
		Baudin's Black-Cockatoo	Old non-breeding birds die, revealing extent of existing breeding inadequacy
		Swift Parrot	Ongoing woodland degradation
		Slender-billed White-eye	Ongoing weed invasion of habitat
Endangered	Vulnerable	Regent Honeyeater	Expanded intensive habitat management
Endangered	Near Threatened	Black-eared Miner	Successful translocations
Endangered	Least Concern	Gouldian Finch	Successful intensive fire and grazing management
Vulnerable	Critical	Southern Giant-Petrel	Increasing temperature, fishing by-catch
Vulnerable	Endangered	Southern Cassowary	Habitat loss in New Guinea
		Rockhopper Penguin	Increasing temperature
		Royal Penguin	Increasing temperature
		Wandering Albatross	Increasing temperature, fishing by-catch
		Grey-headed Albatross	Increasing temperature, fishing by-catch
		Albert's Lyrebird	Increasing temperature
		Mallee Emu-wren	Rainfall decline, drought and fire
Vulnerable	Near Threatened	Malleefowl	Successful habitat management
		Red Goshawk	Successful habitat management

		Sarus Crane	Total loss of Asian population, status purely on the basis of small Australian population
		Noisy Scrub-bird	Successful translocations
		Western Bristlebird	Successful translocations
Near Threatened	Endangered	Flame Robin	Increasing temperature
Near Threatened	Vulnerable	Gentoo Penguin	Increasing temperature
		Northern Giant-Petrel	Increasing temperature
		Grey Petrel	Increasing temperature
		Sooty Shearwater	Increasing temperature, fishing by-catch
		Shy Albatross	Increasing temperature, fishing by-catch
		Light-mantled Albatross	Increasing temperature, fishing by-catch
		Princess Parrot	Buffel Grass (*Cenchrus ciliaris*) invasion of habitat, increasing camel grazing
		Rufous Scrub-bird	Increasing temperature
		Carpentarian Grasswren	Buffel grass invasion of habitat
		Black-throated Finch	Shrub invasion of habitat
		Diamond Firetail	Lower rainfall, ongoing wetland degradation
		Blue-billed Duck	Lower rainfall in core habitat
Near Threatened	Least Concern	Bush Stone-curlew	Loss of southern populations so status based only on smaller, stable northern population
		Beach Stone-curlew	Loss of Asian populations so status based only on smaller, stable Australian population
		Speckled Warbler	Population in fragments stabilised
		Western Whipbird	Successful habitat management
		Pictorella Mannikin	Fears of disease outbreak and sensitivity to grazing not realised
Least Concern	Vulnerable	Lewin's Rail *Rallus pectoralis*	Ongoing wetland degradation, lower rainfall
		Fairy Tern *Sterna nereis*	Disturbance, loss of fish in Coorong
		Gang-gang Cockatoo *Callocephalon fimbriatum*	Increasing temperature
		Red-browed Treecreeper *Climacteris erythrops*	Increasing temperature

		Black Grasswren *Amytornis housei*	Increased fire frequency and intensity
		Kalkadoon Grasswren *Amytornis ballarae*	Invasion of habitat by Buffel Grass
		Rufous Bristlebird *Dasyornis broadbenti*	Increase in temperature
		Atherton Scrubwren *Sericornis keri*	Increasing temperature
		Mountain Thornbill *Acanthiza katherina*	Increasing temperature
Least Concern	Near Threatened	Emu *Dromaius novaehollandiae*	Declining trend continued
		Musk Duck *Biziura lobata*	Lower rainfall in core habitat
		Cape Barren Goose *Cereopsis novaehollandiae*	Increasing temperature
		King Penguin	Increasing temperature
		Flesh-footed Shearwater *Puffinus carneipes*	Fishing by-catch
		Imperial Shag *Leucocarbo atriceps*	Increasing temperature
		Yellow-billed Spoonbill *Platalea flavipes*	Lower rainfall, ongoing wetland degradation
		Black-faced Sheathbill *Chionis minor*	Increasing temperature
		Subantarctic Skua *Catharacta lonnbergi*	Increasing temperature
		Antarctic Tern *Sterna vittata*	Increasing temperature
		Little Tern *Sterna albifrons*	Degradation of Asian breeding habitat
		Palm Cockatoo *Probosciger aterrimus*	Habitat loss in New Guinea
		Eclectus Parrot *Eclectus roratus*	Habitat loss in New Guinea
		Red-cheeked Parrot *Geoffroyus geoffroyi*	Habitat loss in New Guinea
		Rock Parrot *Neophema petrophila*	Increasing temperature
		Blue-breasted Fairy-wren *Malurus pulcherrimus*	Increasing temperature, lower rainfall
		Red-winged Fairy-wren *Malurus elegans*	Increasing temperature, lower rainfall
		Pilotbird *Pycnoptilus floccosus*	Increasing temperature
		Fernwren *Oreoscopus gutturalis*	Increasing temperature
		Striated Fieldwren *Calamanthus fuliginosus*	Increasing temperature
		Macleay's Honeyeater *Xanthotis macleayana*	Increasing temperature
		Bridled Honeyeater	Increasing temperature

Lichenostomus frenatus	
Eungella Honeyeater *Lichenostomus hindwoodi*	Increasing temperature
Pink Robin *Petroica rodinogaster*	Increasing temperature
Western Yellow Robin *Eopsaltria griseogularis*	Increasing temperature, lower rainfall
White-breasted Robin *Eopsaltria georgiana*	Increasing temperature, lower rainfall
Grey-headed Robin *Heteromyias albispecularis*	Increasing temperature
Chowchilla *Orthonyx spaldingii*	Increasing temperature
Spotted Quail-thrush *Cinclosoma punctatum*	Long-term effects of habitat fragmenation
Crested Shrike-tit *Falcunculus frontatus*	Long-term effects of habitat fragmentation
Olive Whistler *Pachycephala olivacea*	Increasing temperature
Paradise Riflebird *Ptiloris paradiseus*	Increasing temperature
Tooth-billed Bowerbird *Scenopoeetes dentirostris*	Increasing temperature
Golden Bowerbird *Prionodura newtoniana*	Increasing temperature
Beautiful Firetail *Stagonopleura bella*	Increasing temperature
Red-eared Firetail *Stagonopleura oculata*	Increasing temperature, lower rainfall

Species of conservation concern with status unlikely to change during period: **Critical:** Abbott's Booby, Christmas Island Frigatebird, Orange-bellied Parrot, Christmas Island Hawk-Owl; **Endangered:** Black-browed Albatross, Lord Howe Woodhen, Buff-breasted Button-quail, Plains-wanderer, Carnaby's Black-Cockatoo, Norfolk Island Green Parrot, Golden-shouldered Parrot, Forty-spotted Pardalote, Eastern Bristlebird; **Vulnerable:** Providence Petrel, Gould's Petrel, Black-breasted Button-quail, Superb Parrot, White-throated Grasswren, Norfolk Island Gerygone; **Near Threatened:** Black-necked Stork, Letter-winged Kite, Grey Falcon, Australian Bustard, Chestnut-backed Button-quail, Hooded Plover, Flock Bronzewing, Partridge Pigeon, New Zealand Pigeon, Chestnut-breasted Whiteface, Painted Honeyeater, Red-lored Whistler, Star Finch.

CONCLUSIONS

While there is enormous uncertainty about the timing of trends, particularly in the 18th and 19th Centuries when many records are missing, the use of environmental change as an analogue for changes in avian abundance, and an understanding of processes operating today, suggest that the exponential growth in threatened bird species is real and likely to continue. The number of threatened species has increased in every period of 50 years in the last 250, with 1.4% of species extinct by 2000, 6.7% threatened (critical, endangered, or vulnerable) and 4.8% near threatened (Figure 12). Most of the losses have been from islands, with every one of the six groups of oceanic islands under Australian jurisdiction having had a reduction in status of the species endemic to them, and all but those in the Indian Ocean having recorded extinctions, at least temporarily. On the mainland intensive development of the agricultural lands in southern and eastern Australia is having a continuing impact on the birds there.

The effect of European colonisation of Australia would probably be far greater by now but for an evolutionary history that has seen major fluctuations in the area of habitat available, and the time lag between perturbation and affect among species as mobile as birds. Nevertheless the scale of destruction and the novelty of threats, particularly on islands with inherently high extinction risk, has resulted in an ever-

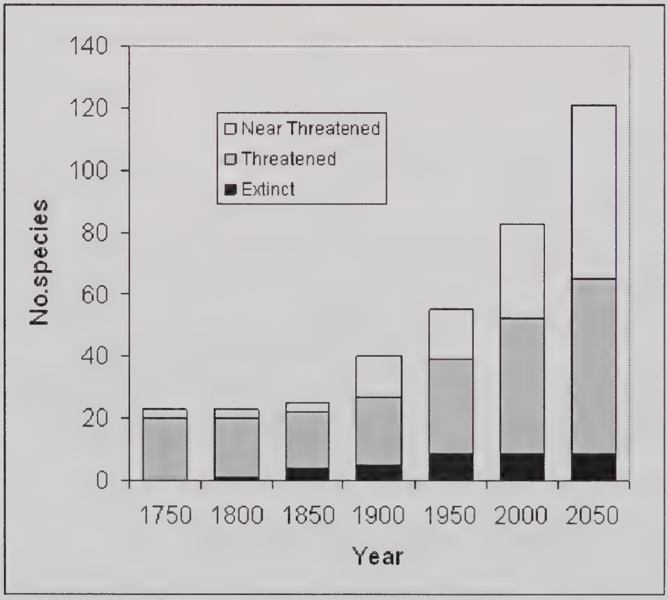

Figure 12. Trend in bird status in Australia from 1750 to 2000, and the number predicted to be of global concern in 2050.

increasing number of bird species being of conservation concern. Land clearance has played the biggest role, particularly in the south, with fire management being the major issue affecting northern species. Overgrazing, particularly by sheep, played a major role in the loss of threatened species, particularly in the late 19th and early 20th centuries.

The future looks little better. While sustained conservation action aimed at saving individual highly threatened species has had substantial success, climate change, historical land clearance, and on-going threats away from Australia pose substantial risks over the next 50 years about which Australia can do little at a national level. Only through concerted global action can these trends be reversed.

ACKNOWLEDGEMENTS

We thank the Conservation Biology Group, Cambridge University, for generously accommodating us through the preparation of the first draft of this manuscript. We also thank John Woinarski (Northern Territory Conservation Commission), David MacFarland (Queensland Parks and Wildlife Service), Richard Loyn (Arthur Rylah Institute), Peter Copley (Department of Environment, South Australia), Allan Burbidge and John Blyth (Department of Conservation, Western Australia), and Matt Cameron (New South Wales National Parks and Wildlife Service) for reviewing the historical conservation status assessments made in this paper. Kristal Coe helped at various stages with referencing and Guy Dutson with final proof-reading..

At another level we also wish to thank the legions of people across the country actively involved in preventing extinction. We have named a few who have made major contributions to stopping declines in species but they all worked in teams. Many other people, equally deserving of praise, have been successful in saving threatened subspecies, or are still striving mightily. The country is indebted to them all.

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